DEDICATED SOLAR SORTIE MISSION SO-01-S SORTIE PAYLOAD Volume III of VI

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MISSION #13 - DEDICATED SOLAR SORTIE MISSION (SO-01-S)

SORTIE PAYLOAD

FUNCTIONAL FLOW DESCRIPTIONS AND PAYLOAD

REQUIREMENTS FOR GROUND AND LAUNCH SUPPORT FACILITIES

Block 1.0 - Activities - Payload Premission Processing

The functional descriptions and launch support facility requirements which follow are based upon:

- o DSSM Definition and Requirements Data, Level B, dated June 7, 1974.
- o Spacelab, Preliminary Technical Description for use in Payload Accommodation Studies, dated 14 June 1974.
- o Launch Site Facility Requirements for Shuttle Payloads (NASA-MSFC), dated May 20, 1974, (functional flow diagrams).

It should be noted that Level B Data is not detailed to the degree required in some cases to determine facility requirements parameters in specific quantitative values. To enhance Study results, assumptions are included where needed. For example, three experiments in the payload require liquid nitrogen for cooling and no requirement for supply of liquid nitrogen is contained in the Level B data. The Study made the assumption that a pallet-mounted liquid nitrogen dewar would furnish the liquid nitrogen, and expended gas was vented overboard through suitable discharge fluid lines.

Another illustration is that the Level B data does not contain a layout of the seventeen experiments in the Orbiter Cargo Bay. The Study assumes the layout as shown in Figure 1-1, and utilizes information contained in the Spacelab, Preliminary Technical Description noted above.

In addition, the Level B data does not include a definition of the equipment in the Orbiter Cabin (PSS, MSS, and other), and this equipment has been omitted in the study.

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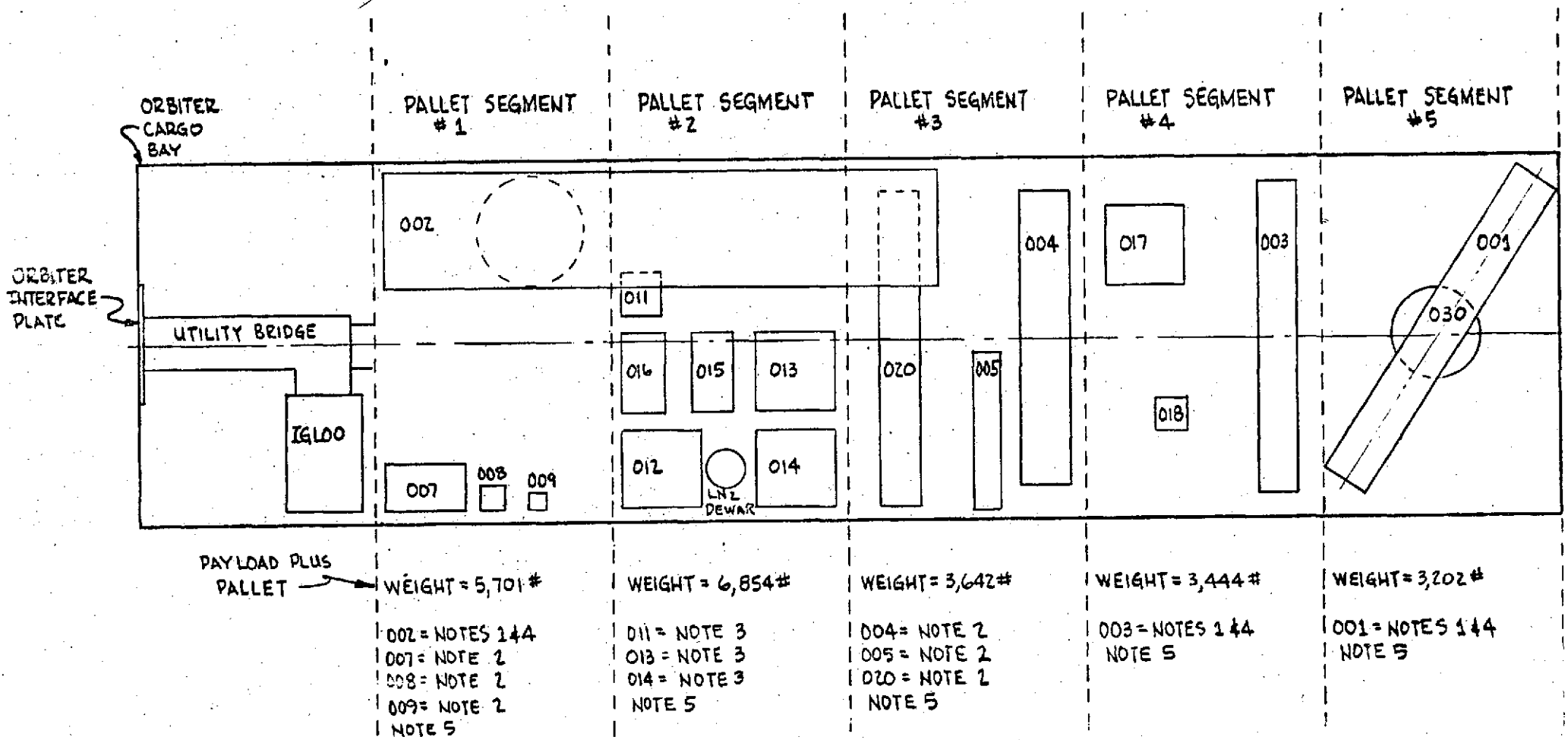
CARGO BAY CONFIGURATION-DEDICATED SOLAR SORTIE MISSION (DSSM)-SO-01-S



NOTES:

1 = INTERNAL GN_2 PURGING
2 = GN_2 PURGING ON PAD, DURING ENTRY, LANDING, & POST LANDING.
3 = LN_2 REQUIRED; LN_2 DEWAR ADDED FOR SUPPLY
4 = FILM REQUIRED
5 = ALL PALLET SEGMENTS CONTAIN ELECTRICAL INTERFACE

Fig. 1-1

Block 1.1 (Configure Experiment Section Pressure Shells) through Block 1.7 (Mate Special Experiment Sections) do not apply to the DSSM.

Block 1.5 - Load and Verify Flight Software - requires equipment not available in the processing flow as shown, and therefore, Block 1.5 has been inserted later in the flow, between Blocks 1.12 and 1.13.

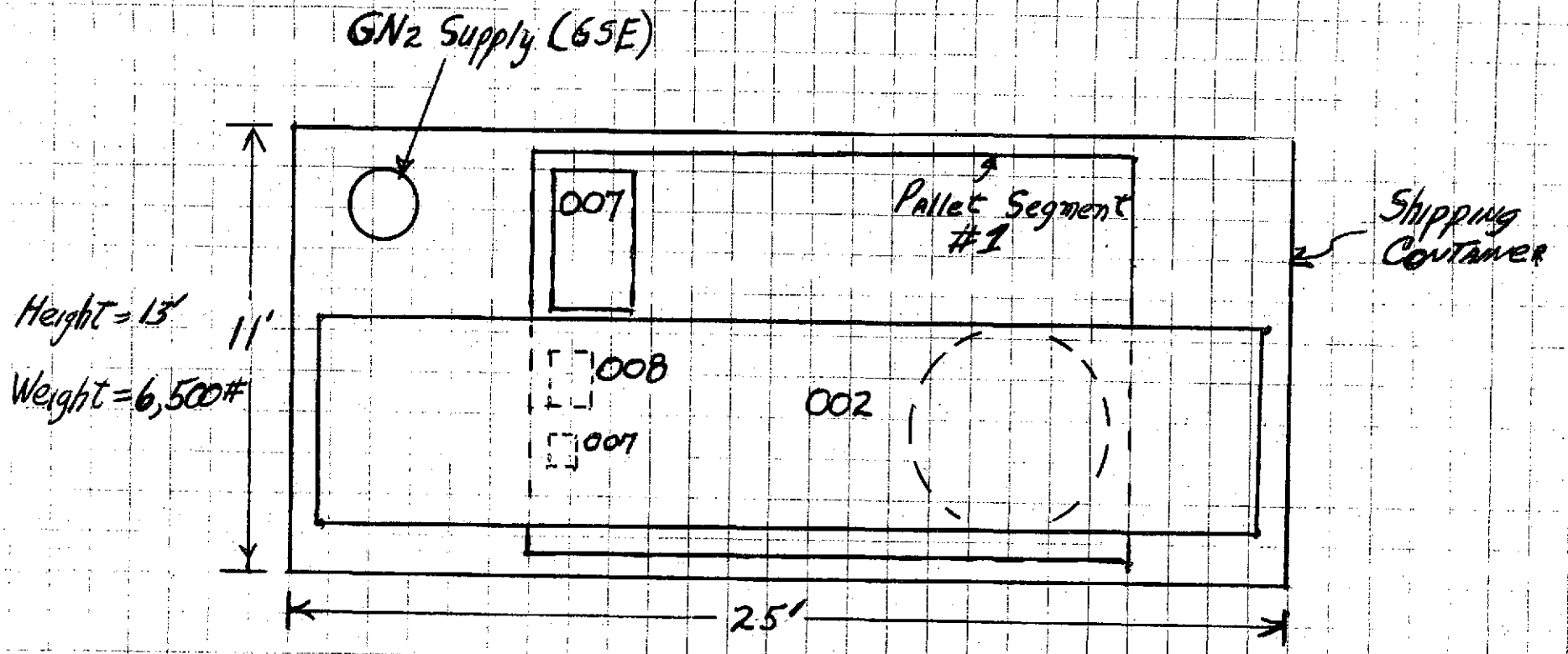
Block 1.8 Receive and Inspect Pallet Sections

Block 1.8.1 Pallet Sections arrive at launch site via air transportation. Figure 1-2 shows the anticipated con iguration of the largest size pallet segment (Pallet Segment #1) upon arrival at launch site. This pallet segment is flowed through the Payload Premission Processing. Other pallet segments have similar flow; however, differences are described when occurring. Some experiments require GN_2 pruging, and it is assumed that the purging function involves a GN_2 blanket pressure with a GN_2 supply to furnish pressure decay caused by leakage. In the transportation mode, the GN_2 supply is included in the shipping container as GSE which is shown in Figure 1-2.

The logic of selecting air transportation for the pallet segments from the NASA DSSM Development Center to the launch site is based upon the size and weight of pallet segment shipping containers (suitable for C5A aircraft), and the advantage of short travel time and transportation control afforded by C5A transport versus rail/truck/sea transport.

Ground and Launch Support Facility Requirements

This block establishes the initial conditions of the pallet segments upon arrival at the launch site, and does not involve ground and launch support facility requirements.



Pallet Segment #1 Shipping Configuration

Figure 1-2

Block 1.8.2 Unload Pallet Sections from Commercial Carrier and Place in Temporary Storage

The pallet segment in its shipping container is removed from the C5A aircraft, loaded on a flat-bed trailer, towed to a temporary protected storage area, and unloaded from the trailer.

Ground and Launch Support Facility Requirements

Facility Requirements

- o Protected storage area (hangar-type protection satisfactory)
  - 75 feet long, 35 feet wide, and 20 feet high for five pallet segments which allows six foot aisle between shipping containers.
- o GN_2 supply (contingency for experiment pruging).
- o Refrigerated film storage.

Support Requirements

- o Air Force 463L Material Handling System (for unloading C5A aircraft).
- o Flat-bed trailer (10,000 lbs. capacity, 25 feet long, 10 feet wide).
- o Tow tractor (for flat-bed trailer).
- o Crane, mobile (8,000 lbs. capacity).
- o Pallet Segment Shipping Container Hoisting Sling.
- o Operators for tow tractor, crane, and 463L Material Handling System.
- o Riggers
- o Traffic Security Personnel

Block 1.8.3 Transport Pallet Sections from Temporary Storage to Receiving Area of PPF

The pallet segments are removed from temporary storage and transported to the receiving area of the PPF to meet the requirements of the Orbiter launch schedule.

The functional flow described generates an even distribution of work for the tasks of pallet segment unpacking, pallet segment interface verification, and pallet segment installation in the Holding Fixture (Cargo Bay Simulator). The unpacking is accomplished in series, the interface verification in parallel, and the installation in series.

Ground and Launch Support Facility Requirements

Facility Requirements

- o Receiving area of PPF
  - 35 feet long, 20 feet wide, and 20 feet high, with entry door 19 feet high, 13 feet wide.
- o GN_2 supply (contingency for experiment purging)

Support Requirements

- o Flat-bed trailer (10,000 lbs. capacity, 25 feet long, 10 feet wide).
- o Tow tractor (for flat-bed trailer).
- o Crane, mobile (8,000 lbs. capacity).
- o Operators for tow trailer and crane.
- o Riggers.
- o Pallet Segment Shipping Container Hoisting Sling.
- o Traffic Security Personnel.

Block 1.8.4 Unpack Pallet Sections and Place in Holding Fixture (Movable, and Simulates Orbiter Cargo Bay)

Various concepts were considered for unpacking the pallet segments. The one described below distributes work tasks throughout the PPF. The selected unpacking procedure follows:

Step 1 - Position Holding Fixture alongside flat-bed trailer.

Step 2 - Remove roof bulkhead of pallet segment shipping container, and hoist clear.

Step 3 - Attach hoisting sling to pallet segment, and hoist vertically clear of shipping container, translate to Holding Fixture, and lower in place.

Step 4 - Replace roof bulkhead of shipping container.

Step 5 - Open PPF door, and tow shipping container to temporary protected storage.

The recommended "Holding Fixture" for the DSSM is a Cargo Bay Simulator (CBS) and is conceptually defined as a movable fixture which duplicates the Orbiter Cargo Bay as concerns mounting provisions, mechanical clearances including Cargo Bay Doors, manipulator installation, and all electrical and fluid interface connections. The CBS is wheeled to permit movement within the PPF, and serves as the transporter for payload transfer from PPF to CPF. The CBS in modular in construction, that is, built up in sections (such as, 10 ft. or 15 ft.), such that forward and aft bulkhead sections contain the wheels. Thus, for the DSSM whose total length in the Cargo Bay is estimated to be 60 ft., the CBS is built-up on one forward bulkhead section of 10 ft., one aft bulkhead section of 10 ft., and four 10 ft. middle sections for a total length of 60 ft. (ten foot sections used for illustration).

After installation of the first pallet segment in the Cargo Bay Simulator (CBS), the CBS is moved to the checkout area of the PPF where interface verification tests are begun.

The other pallet segments are transported from temporary storage to the PPF

receiving area and unpacked as described above in series. As the CBS is no longer in the receiving area, the pallet segments are placed on movable pallet segment dollies.

Ground and Launch Support Facility Requirements

Facility Requirements

- Overhead crane (10,000 lbs. capacity, 20 foot vertical travel capability).
- GN_2 supply (for experiment purging).
- Receiving area of PPF
  - 72 feet long (CBS = 60 feet, end clearance 6 feet both ends), 41 feet wide (shipping container = 11 feet, CBS = 18 feet, side clearance 6 feet both sides), height = 30 feet (trailer and shipping container = 16 feet, pallet segment and clearance = 14 feet).

Support Requirements

- Cargo Bay Simulator (CBS).
- Operators for crane.
- Riggers.
- Slings for Pallet Sigment Shipping Container Roof/Bulkhead, Pallet Segment Shipping Container, and Pallet Segment.
- Tools and procedures for removal/replacement of Pallet Segment Shipping Container roof bulkhead.
- Tools and procedures for pallet segment hoisting.
- Movable pallet segment dollies.

Block 1.8.4.1 Transport Pallet Sections Shipping Containers to Temporary/Long Term Storage

This block removes the Pallet Segment Shipping Containers from the receiving area of the PPF, and returns them to temporary protective storage (one to two months). It is assumed that after the seven day orbit mission the shipping containers will be reused to return the pallet segments to the NASA DSSM Development Center.

Ground and Launch Support Facility Requirements

Facility Requirements

- o Protective storage area
  - Same as Block 1.8.2

Support Requirements

- o Flat-Bed trailer (2,000 lbs. capacity, 25 feet long, 10 feet wide)
- o Tow tractor (for flat-bed trailer).
- o Crane, mobile (2,000 lbs. capacity)
- o Pallet Segment Shipping Container hoisting sling.
- o Operators for tow tractor and crane.
- o Riggers
- o Traffic Security personnel.

Block 1.8.5 Conduct Visual Inspection, and Record Transport Sensor Readings to Verify Post-transportation Integrity

Level B data does not specify transport sensors in the DSSM; however, it is anticipated that accelerometers, desiccants, GN_2 pressure indicators and the like will be installed to verify post-transportation integrity.

The data of these sensors are recorded and visual inspection of the pallet segment is performed.

Ground and Launch Support Facility Requirements

Facility Requirements

- GN_2 supply (continued)

Support Requirements

- Procedures and inspection tools (flash light, mirror, etc.) for recording sensor and performing visual inspection.

Block 1.8.6 Move Pallet Sections (in Holding Fixture) to Checkout Area in PPF

A pallet segment in the Cargo Bay Simulator (CBS) is towed to the checkout area in the PPF. As scheduled, the other four pallet segments are moved on their movable pallet segment dollies to the PPF checkout area.

Ground and Launch Support Facility Requirements

Facility Requirements

- o GN_2 supply continues.
- o PPF Checkout Area
  - 80 feet long (CBS = 60 feet, 10 feet work stands both ends), 35 feet wide (CBS = 15, 10 foot work stands both sides), and 39 feet height (CBS = 18 feet, payload - 15 feet, and 6 foot clearance).

Support Requirements

- o Tow tractor for CBS and pallet segment dollies.
- o Operator for tow tractor.

Block 1.8.20 Pallet Sections GSE Arrives at Launch Site Via _____

The pallet segment GSE arrives at the launch site via C5A aircraft, and, to the extent practical for C5A load, in the same aircraft with its supported pallet segment.

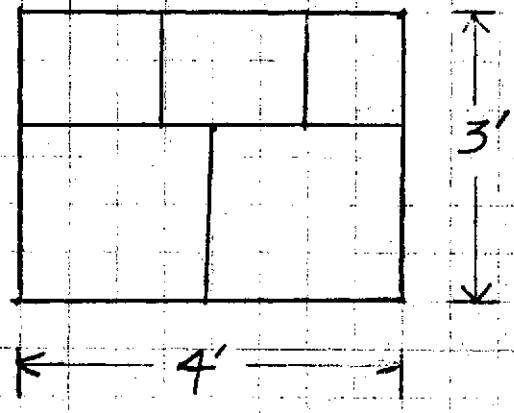
Level B data does not contain definition of DSSM GSE. For purposes of the Study, the DSSM GSE configuration to verify interfaces between pallet segments, and between the integrated DSSM and the Orbiter, is shown in Figure 1-3.

Ground and Launch Support Facility Requirements

This block establishes initial conditions fo DSSM GSE upon arrival at the launch site, and does not require ground and launch support facility requirements.

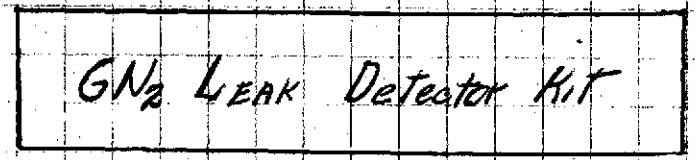
DSSM GSE CONFIGURATION

Electrical GSE
(5 racks, each)



2' deep
WT = 250 #

Fluid GSE



4' x 1' x 1'
WT = 50 #

Figure 1-3

Block 1.8.21 Unload GSE from Commercial Carrier and Place in Temporary Storage

The DSSM GSE, assumed to be five racks of electrical equipment and one GN_2 leak detector kit, is removed from the C5A aircraft, and placed in temporary protective storage until required for PPF processing.

Ground and Launch Support Facility Requirements

Facility Requirements

- Protected storage area (Hangar - type satisfactory)
  - 30 feet long, 24 feet wide, 5 feet high

Support Requirements

- Air Force 463L Material Handling System (for unloading C5A aircraft).
- Fork lift truck.
- Trucks ($2\frac{1}{2}$ ton, closed body).
- Operators for fork lift trucks, and $2\frac{1}{2}$ ton turcks.
- Inventory Management.

Block 1.8.22 Transport GSE from Temporary Storage to Receiving Area of PPF

As required for DSSM processing, the DSSM GSE is moved from temporary storage to the receiving area of the PPF.

Ground and Launch Support Facility Requirements

Facility Requirements

- PPF receiving area (area for two electrical GSE racks)
  - 20 feet long, 16 feet wide, 4 feet high

Support Requirements

- Fork lift trucks.
- Trucks ($2\frac{1}{2}$ ton, closed body).
- Operators for fork lift trucks and $2\frac{1}{2}$ ton trucks.
- Inventory Management.

Block 1.8.23 Unpack GSE, and Place on Dolly

In the receiving area of PPF, the DSSM GSE is unpacked, and placed on movable utility dollies.

Ground and Launch Support Facility Requirements

Facility Requirements

- None

Support Requirements

- Fork lift trucks.
- Movable utility dollies (5 feet long, 3 feet wide).
- Operators for fork lift trucks.
- Tools and procedures for uncrating DSSM GSE.
- Technicians for uncrating operations.

Block 1.8.23.1 Transport GSE Shipping Containers to Temporary Storage

After uncrating the DSSM GSE, the shipping containers are transported from PPF to temporary storage. It is anticipated that the DSSM GSE will re-use the shipping containers after Orbiter launch for return of DSSM GSE to the NASA DSSM Development Center.

Ground and Launch Support Facility Requirements

Facility Requirements

- Temporary storage area.
  - 30 feet long, 24 feet wide, 5 feet high

Support Requirements

- Fork lift trucks.
- Trucks ($2\frac{1}{2}$ ton)
- Operators for fork lift trucks and $2\frac{1}{2}$ ton trucks.
- Inventory Management.
- Tools and procedures for reassembly of shipping containers.

Block 1.3.24 Conduct Visual Inspection and Record Sensor Readings to Verify Post-transportation Integrity

The assumption is made that the DSSM GSE has no installed transport sensors, so sensor recordings are not applicable.

A visual inspection of the DSSM GSE is made to verify post-transportation integrity.

Ground and Launch Support Facility Requirements

Facility Requirements

- None

Support Requirements

- Procedures and inspection tools (flash light, mirrors, etc.) for performing visual inspection.
- Technicians for conducting inspection.

Block 1.8.25 Move GSE to Checkout Area of PPF

The DSSM GSE, mounted on movable dollies, is moved from the receiving area to the checkout area in the PPF.

Ground and Launch Support Facility Requirements

Facility Requirements

- o PPF Checkout area.
  - 12 feet long, 8 feet wide, 4 feet high for utility dollies.

Support Requirements

- o None

Block 1.9 Install Crew Transfer Access Tunnel and Aft Bulkhead

(This block is not applicable to Study. For DSSM, a pallet only mission, there are no tunnel and aft bulkhead.)

Block 1.10 Mate Pallet with Pressurized Sections

NOTE: This block has been changed to include verification test of the Pallet Sections interfaces prior to connecting the Pallet Sections together. The justification for this change is that malfunction detection is more economical and has less probability of impacting the Shuttle launch schedule when performed on a "build-up" basis instead of an a "system" basis. In addition, the DSSM pallet segments have not been functionally checked since launch site arrival, and to delay the check until after all five pallet segments have been joined would appear to invite duplication of installation/removal activities and resulting increases in time requirements and costs for ground operations.

The activities in Block 1.10 are to verify the pallet segment interfaces prior to installing the pallet segments into the Cargo Bay Simulator (CBS). One typical interface verification test in block diagram form is shown in Figure 1-4.

INTERFACE VERIFICATION - Pallet Segment #1 (Typical)

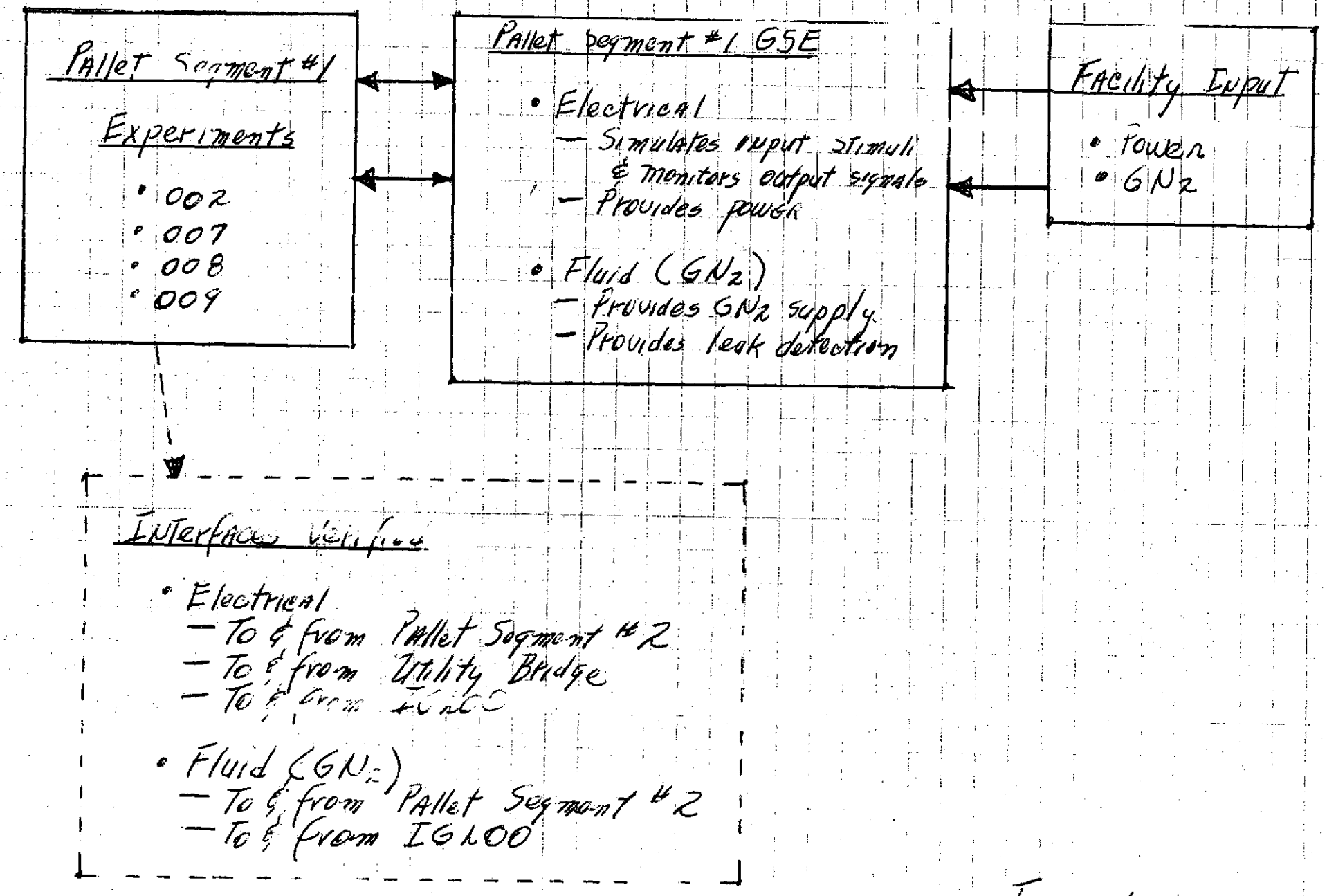


Figure 1-4

Block 1.10.1 Perform Functional Check and Calibration of GSE

It is assumed that the Pallet Segment GSE requires no calibration, and that the functional check of the GSE is conducted using standard test equipment. Since the definition of DSSM GSE is TBD, the requirements for standard test equipment is TBD at this time.

Ground and Launch Support Facility Requirements

Facility Requirements

- Electrical Power - TBD
- Calibration Lab - TBD
- GN_2 - TBD

Support Requirements

- Standard test equipment - TBD
- Checkout/Calibration Procedures - TBD
- Technicians to perform checkout/calibation

Block 1.10.2 Connect GSE to Pallet Sections Requiring Calibration, and Calibrate Pallet Sections

Level B data of DSSM does not identify calibration requirements for the experiments, therefore, these requirements are TBD.

Ground and Launch Support Facility Requirements

- TBD

Block 1.10.3 Connect GSE to Pallet Sections Interfaces

Block 1.10.4 Perform Verification Tests of Pallet Sections Interfaces

Block 1.10.5 Remove Pallet Sections Verification GSE

The three blocks conduct the pallet segment verification tests. Figure 1-4 shows a typical pallet segment verification test interconnections, and indicates the interfaces verified. For Pallet Segment #1, GN_2 interfaces between the segment and the IGLOO and Pallet Segment #2 are tested. The GSE simulates the input/output of the Pallet Segment #2 and the IGLOO.

In like manner, the electrical interfaces are verified. For Pallet Segment #1 electrical interfaces exist with Pallet Segment #2, the IGLOO, and the Utility Bridge.

During these tests, GSE furnishes electrical power and GN_2 to Pallet Segment #1. The GSE in turn is supplied these items by the facility.

Ground and Launch Support Facility Requirements

Facility Requirements

- GN_2 - TBD
- Electrical Power - TBD

Support Requirements

- Tools and procedures for mating/unmating GSE.
- Procedures for conducting verification tests.
- Data/Computer processing (parameters - TBD).
- Refrigerated Film Storage.
- Electrical and Fluid Technicians.

NOTE: Data Sheet #S-23 - Ground Facility Requirements - of the DSSM Level B data indicates various launch site ground facility requirements which do not appear appropriate for Level II integration activities. As an example, an altitude chamber, a vacuum chamber, and a solar simulator/gamma ray source are listed as launch site ground facility requirements

Block 1.10.5 (continued)

NOTE: (continued)

on Data Sheet #S-23. It is felt that these items would not be involved in performing Level II integration activities at the launch site, and such requirements have been omitted from the Study.

Block 1.10.6 Inspect Pallet Sections to Verify Configuration is Correct for mating with Pressurized Sections

This inspection is performed to verify that the Pallet Segments are in the proper configuration for installation into the Cargo Bay Simulator.

All mechanical, fluid, and electrical interfaces of the Pallet Segments are inspected for correct configuration.

Ground and Launch Support Facilities Requirements

Facility Requirements

- None

Support Requirements

- Inspection procedures, tools, and configuration descriptions/drawings of mechanical, fluid, and electrical interfaces.
- Mechanical/fluid/electrical Technicians.

Block 1.10.7 Mate Pallet Sections with Pressurized Sections

This block installs the Pallet Segments in the Cargo Bay Simulator (CBS), and mates the pallet segments.

Prior to installing the pallet segments into the CBS, an inspection of the CBS is conducted to verify that the CBS is configured correctly to receive the pallet segments.

The Pallet Segments, located on movable pallet segment dollies, are hoisted from the dollies by an overhead crane, and lowered into their position in the CBS.

Once in the CBS, all mechanical, fluid, and electrical interfaces between pallet segments are mated.

The IGLOO and Utility Bridge have their interfaces verified, and then they are installed in the CBS. After these items are in place in the CBS, the interface connections are made.

This block concludes with all Orbiter Cargo Bay equipment installed in the CBS, and ready for Orbiter Simulator verification test (named Final Integrated Systems Tests - Block 1.13).

Ground and Launch Support Facility Requirements

Facility Requirements

- o PPF checkout area
  - CBS area; 80 feet long, 35 feet wide, 39 feet height.
  - Pallet Segment area; 15 feet long, 10 feet wide, and 18 feet height.
- o Overall crane (8,000 lbs. capacity).

Support Requirements

- o Procedures and tools for configuration inspection of CBS.
- o Procedures and tools for hoisting pallet segments.
- o Slings for hoisting pallet segments.
- o Procedures and tools for mating mechanical, fluid, and electrical interface connections between pallet segments.
- o Procedures and tools for verifying IGLOO and Utility Bridge interfaces

Block 1.10.7 (continued)

Support Requirements (continued)

- Procedures and tools for mating IGLOO and Utility Bridge Interfaces.
- Mechanical/fluid, and electrical technicians.
- Riggers.
- Operator for overhead crane.

Block 1.11 Mate Pallet Sections with Liaison Pallet

This block is not applicable to the DSSM flight.

Block 1.12 Connect Orbiter Simulator

This block is not applicable to the Study. (However, the following comments are offered.

It is recommended that the forward bulkhead of the "Holding Fixture" - called the Cargo Bay Simulator in this Study - duplicate the forward end of the Orbiter Cargo Bay, which then serves as an interface simulator between the Spacelab and the Orbiter. The equipment of the Orbiter Simulator would be a series of rack-mounted equipment on dollies which simulate the Orbiter PSS/MSS, and cabin mounted payload equipment. The forward bulkhead of the CBS would have provisions for mounting a manipulator rig in case functional verification tests between the manipulator and payload are accomplished during ground operations in the PPF.

The Level B data for DSSM indicates that the pressurized equipment will be provided by Spacelab (Data Sheet #S-5). In addition, Data Sheet S-7a and S-7b indicate other equipments to be located in a pressurized area. The Orbiter Simulator simulates all such equipment as this).

Block 1.5 Load and Verify Flight Software

All equipment is now assembled for flight software verification; that is, Orbiter Simulator as defined in Block 1.12 contains necessary equipment located in Orbiter, and the payload equipment completely installed in the Cargo Bay Simulator, so that data channels are mated. It is anticipated that the software verification activity will be conducted by launch site personnel, and therefore, these activities are not detailed here.

Block 1.13 Final Integrated Systems Tests

This block verifies the interface between the Orbiter Simulator and these Spacelab elements which mate with the Orbiter Simulator. This definition is in keeping with the ground rule of verifying interfaces at the launch site, and since all interfaces within the Pallet Segments, IGLOO, and Utility Bridge have been verified previously in the functional flow processing, only the interface between the Orbiter Simulator and the Orbiter Interface Plate (Figure 1-1) located on the CBS forward bulkhead, requires verification during the final integrated systems tests.

The concept of the Orbiter Simulator is defined in Block 1.12 above.

The interfaces verified in this block are based upon those contained in JSC 07700, Volume XIV, "Payload Accommodations".

Block 1.13.1 Verify Structural/Mechanical Interfaces

Block 1.13.1.1 Mechanical Verification of Transfer Tunnel Fitting on Payload Bay Hatch

This block is not applicable to DSSM.

Block 1.13.1.2 Mechanical, Fluid, Electrical Verification of Service Panel Connections on Spacelab

Level B data does not contain definition of the supply of GN_2 and LN_2 for the experiments; if these fluids are serviced through the Orbiter Service Panel, these interfaces would be verified.

Block 1.13.2 Verify Avionics Interfaces

The following avionics interfaces are verified in the DSSM

- o Data Processing and Software Subsystem.
- o Communications and Tracking Subsystem.

Block 1.13.3 Verify Electrical Power Subsystem Interface

This interface is verified at the Orbiter Interface Plate (Figure 1-1).

Block 1.13.4 Verify the Environmental Control and Life Support (ECLS) Subsystem Interfaces

Block 1.13.4.1 Verify the Atmospheric Revitalization Subsystem (ARS) Interfaces

The DSSM contain no ARS interface.

Block 1.13.4.2 Verify the Active Thermal Control Subsystem (ATCS) Interfaces

The DSSM Level B data does not include ATCS requirements.

Ground and Launch Support Facility Requirements for Block 1.13

Facility Requirements

- o Electrical Power - TBD.
- o GN_2 - TBD.

Ground and Launch Support Facility Requirements for Block 1.13 (continued)

Support Requirements

- Orbiter Simulator.
- Verification Test Procedures.
- Electrical, Fluid, and Mechanical Technicians.
- Data processing (parameters are TBD).

Block 1.14 Service Non-time Critical Items

The DSSM Level B data does not include service requirements (non-time critical). Candidates include the servicing of GN_2 supply for instrument purging. If the IGLOO supplies the purging GN_2, the servicing of GN_2 would be performed in this block.

Ground and Launch Support Facility Requirements

Facility Requirements

- Electrical Power - TBD
- GN_2 - TBD.

Support Requirements

- GN_2 Control Cart.
- Procedures for GN_2 servicing.
- Fluid Technicians.

Block 1.15 Perform Pressure Integrity Tests

This block is not applicable to the DSSM.

Block 1.16 Disconnect Orbiter Simulator

This block disconnects the interfaces between the Orbiter Simulator and the Cargo Bay Simulator (CBS), and secures the CBS interfaces in preparation for moving the CBS from the PPF to the OPF.

The Orbiter Simulator is assumed to contain various rack-mounted DSSM equipment which is located in the Orbiter Cabin (PSS/MSS) during the flight mission. This equipment is called DSSM Cabin Equipment in the functional activities described below.

Block 1.16.1 Disconnect Interfaces between Orbiter Simulator and CBS

The Orbiter Interface Plate (Figure 1-1) connections are unmated. This interface is primarily electrical, although there may be fluid lines for supply of GN_2 to the IGLOO, and for exhaust GN_2 discharge lines from expended LN_2.

Block 1.16.2 Install Protective Covers on Orbiter Interfaces Plate

A protective cover is installed over the Orbiter Interface Plate for environmental protection during the transport of the CBS from PPF to the OPF.

Block 1.16.3 Disconnect Interfaces between Orbiter Simulator and DSSM Cabin Equipment

The interfaces between Orbiter Simulator and DSSM Cabin Equipment are unmated. Although mainly electrical, these interfaces also involved mechanical release of the racks and individually mounted equipment.

Block 1.16.4 Install Protective Covers on DSSM Cabin Equipment

Protective covers are placed over the DSSM Cabin Equipment for environmental protection during transport from PPF to OPF.

Ground and Launch Support Facility Requirements

Facility Requirements

- Overhead crane (capacity 1,000 lbs.)

Ground and Launch Support Facility Requirements

Support Requirements

- Procedures and tools for disconnecting interfaces at Orbiter Interface Plate.
- Procedures and tools for disconnecting interfaces between Orbiter Simulator and DSSM Cabin Equipment.
- Protective covers, installation procedures, and tools for Orbiter Interface Plate and DSSM Cabin Equipment.
- Fork lift trucks.
- Operators for overhead crane and fork lift truck.
- Mechanical/electrical technicians.

Block 1.17 Move to OPF

This block moves the Cargo Bay Simulator (CBS) and the DSSM Cabin Equipment from the PPF to the OPF. The CBS is towed, and the DSSM Cabin Equipment is loaded in closed-body trucks which transport the equipment to the OPF.

The concept of the CBS includes a closed container which affords protection to the pallet-mounted instruments during transit. However, some of the instrument may require GN_2 purge during the move; therefore, a supply of GN_2 is included in the ground requirements.

Block 1.17.1 Perform Functional Check, Calibration, and Service GSE as Required

A supply of GN_2 may be required during transport from PPF to OPF. Bottled GN_2 with appropriate valving would satisfy this requirement.

Block 1.17.2 Position GSE on Trailer which Accompanies Cargo Bay Simulator during Tow from PPF to OPF

The GN_2 bottle would be installed adjacent to the IGLOO, and connected to the IGLOO GN_2 supply.

Block 1.17.3 Install Protective Covers on Pallet-mounted Experiments

It is anticipated that this block is not applicable to the DSSM, since the experiment protective covers have not been removed.

Block 1.17.4 Connect GSE to Protective Covers

This block is not applicable to the DSSM.

Block 1.17.5 Power up GSE and Supply Cleanliness Requirements, and Monitor GSE Output

This block is not applicable to the DSSM.

Block 1.17.6 Attach Tow Tractor to CBS, and Tow to OPF

All workstands are moved clear of the CBS, and a verification inspection is made on the CBS to determine it is ready for transport to the OPF. Configuratio of the payload is verified for the move also.

A tow tractor is attached to the CBS, the PPF doors opened, and the CBS is towed to the OPF.

Block 1.17.10 Remove DSSM Cabin Equipment from Orbiter Simulator

The DSSM Cabin Equipment is removed from the Orbiter Simulator, placed on movable dollies, and verification performed to determine its proper configuration for transport to the OPF.

Block 1.17.11 Load DSSM Cabin Equipment on Trucks and Transport to OPF

The DSSM Cabin Equipment is loaded on closed body trucks, and transported to the OPF.

Ground and Launch Support Facility Requirements

Facility Requirements

- Overhead crane (capacity 2,000 lbs).
- GN_2 - TBD.

Support Requirements

- Tow Tractor for CBS.
- Fork lift trucks.
- Procedures and tools for configuration verification of CBS and DSSM.
- Procedures and tools/slings for handling DSSM Cabin Equipment.
- Trucks $2\frac{1}{2}$ tons closed body.
- Operators for tow tractor, overhead crane, and forklift trucks.
- Riggers.
- Mechanical Technicians.

Block 2.0 Orbiter/Payload Integration and Checkout - Mission No. 13

The activities in this functional block begin with the arrival of the integrated payload elements at the mating area of the Orbiter Processing Facility and include all those efforts required to physically and functionally mate the payload to the Orbiter Payload Bay, and install any equipment required for the mission in the Payload Specialist Station. Figure 2.2-1 graphically depicts this flow.

The prerequisites of entering this block are as follows:

- o All elements requiring integration have been integrated.
- o Required GSE, STE, facility services and personnel are available.
- o Orbiter processing has progressed to the required point in its turnaround flow and is ready to accept the Payload.

Block 2.1 Install Payload in Orbiter Payload Bay

Conditions Payload is in position and access stands are in place.

Block 2.1.1 Lock transporter in position and remove all transport covers.

Block 2.1.2 Verify no transport damage has been incurred and payload and associated hardware is in a mate condition (visual inspection).

Block 2.1.3 With the overhead crane in position, attach the auxiliary crane control to the hook and the hoisting GSE to the crane control. Raise the assembled functional set and attach to payload hoist points.

Block 2.1.4 Using the auxiliary control, apply a load of TBD pounds as indicated on the dial face. Unlatch all transporter hold down points and raise payload clear of the transport unit.

Block 2.1.5 Hoist and position in payload bay. Using the auxiliary control lower onto the orbiter support points.

Block 2.1.6 Install all related mission equipment in the Payload Specialist Station.

Block 2.1.7 Secure all payload bay latches and verify.

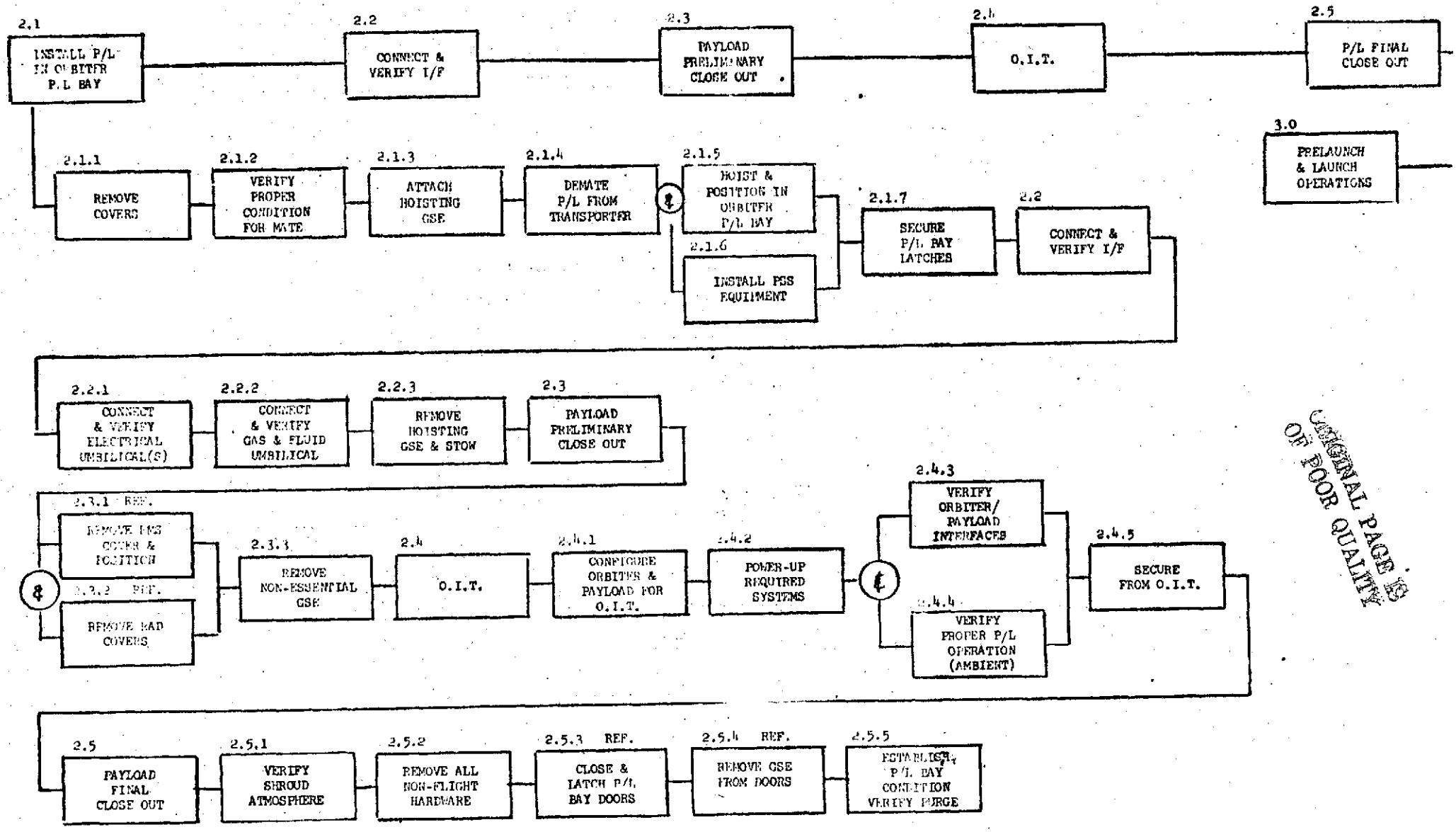


FIGURE 2.2-1 ORBITER/PAYLOAD INTEGRATION

Support Requirements Functional Block 2.1

Facilities

Floor space 2700 ft^2 (90 x 30)

Overhead crane 10 ton capacity

GN_2

Ground Support Equipment

Hoist, Functional Set

Stands, Access

Auxiliary Crane Control

Support

Crane Operator

Personnel

Technicians

Q.C.

Safety

Engineering

Logistics

Procedures

Block 2.2 Connect and Verify Orbiter/Payload Interfaces

Conditions Payload is mechanically mated to the Orbiter and latch-down has been verified.

Block 2.2.1 Verify power off on both sides of the electrical interface. When verified, mate the Orbiter to Payload umbilical(s).

Block 2.2.2 Verify no pressure or fluid present at either side of the fluid/gas umbilical.

Block 2.2.3 Disconnect hoisting GSE and hoist clear of payload bay, retain in the area.

Support Requirements for Functional Block 2.2

Facilities

Same as 2.1.

Support Requirements for Functional Block 2.2 (Continued)

Ground Support Equipment

Same as 2.1

Support

Crane Operator

Personnel

Technicians

Q.C.

Safety

Engineers

Logistics

Procedures

Block 2.3 Payload Preliminary Closeout

Conditions Payload has been physically and functionally mated to the Orbiter.

Block 2.3.1 Remove protective covers from the Remote Manipu ator System (RMS) arms. (Reference only not a payload function.)

Block 2.3.2 Remove protective covers from the payload bay door mounted radiators. (Reference only, not a payload function.)

Block 2.3.3 Remove all non-essential GSE and stow. Retain in area.

Support Requirements for Functional Block 2.3

Same as 2.2.

Block 2.4 Perform Orbiter Integrate Test (OIT)

Conditions Preliminary payload closeout has been completed. Orbiter support available and verified.

Block 2.4.1 Configure orbiter, payload and associated GSE to support OIT position switches and circuit breakers per test procedures and verify.

Block 2.4.2 Apply ground power to the required systems and verify proper level and distribution.

Block 2.4.3 Verify functional path through Orbiter/Payload interface paths.

Block 2.4.4 Verify proper signal format and level for all operating payload elements.

Block 2.4.4.1 Figure 2.2-2 is a graphic representation of a typical anomaly loop and indicates various options in effecting corrective action. Once the anomaly has been isolated, the decision on which path to follow will be a "real time" decision based on repair requirements and/or mission criticality. It is assumed that any anomaly associated with the Orbiter or the Institutional Ground Support Equipment will be the responsibility of KSC operational personnel, while anomalies within the payload elements or Peculiar Ground Support Equipment will be corrected by the payload operations personnel.

~~Figure 2.2-3 shows typical offline functional flow for these two cases.~~

Block 2.4.5 Upon final verifications of the correct readouts and functional interfaces, secure from O.I.T. power down active systems and position all switches and circuit breakers as called for in the O.I.T. procedures.

Support Requirements for Functional Block 2.4

Facilities

Same as 2.1. plus 115 VAC 1 ϕ 60 HZ (TBD KW)

and 110 VAC 400 HZ

Ground Support Equipment

GN_2 Regulating Unit

Hose Set

Cable Set(s)

Service Set, LN_2

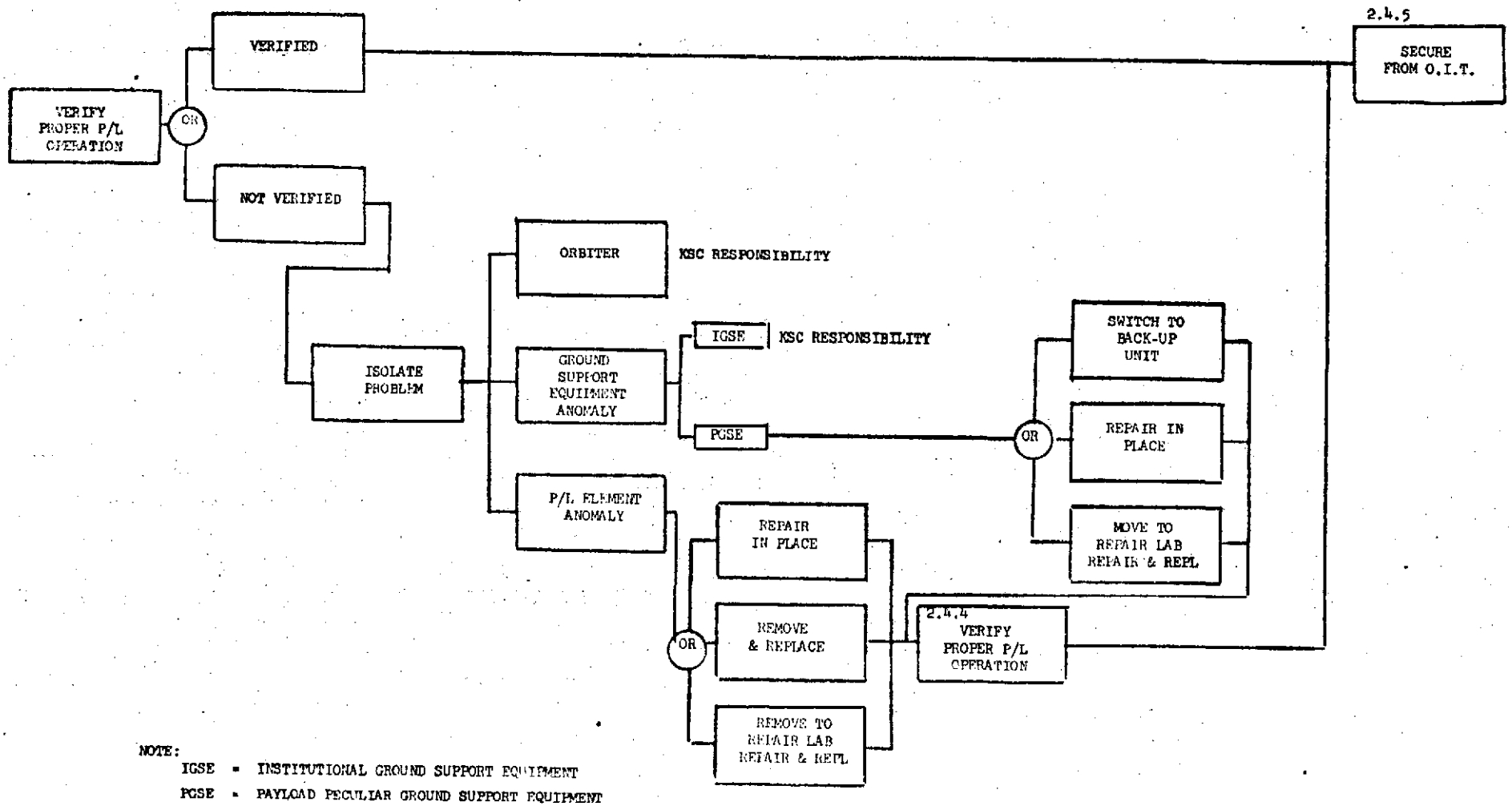
Support

None

Personnel

Technicians

Q.C.



NOTE:
IGSE = INSTITUTIONAL GROUND SUPPORT EQUIPMENT
PGSE = PAYLOAD PECULIAR GROUND SUPPORT EQUIPMENT

FIGURE 2.2-2 TYPICAL ANOMALY FUNCTIONAL LOOP

Block 2.4.5 Personnel (Continued)

Safety

Engineer

Logistics

Procedures

Block 2.5 Payload Final Close-out

Conditions Orbiter Integrated Test has been completed. Orbiter and Payload have been secured.

Block 2.2.5.1 Service flight systems. If systems are serviced during OIT, top-off only will be required.

Block 2.5.2 Remove all non-flight hardware from the payload bay and any non flight equipment from the payload specialist station.

Block 2.5.2.1 Return all payload handling/checkout GSE to its proper position.

NOTE: This PGSE may be stored at the launch site or returned to the PI or CIS facility.

Block 2.5.3 Close and latch payload bay doors, (Reference only, not a payload function).

Block 2.5.4 Remove payload bay doors GSE and return to storage (Reference only, not a payload function).

Block 2.5.5 Establish payload bay conditioning purge, verify payload bay conditioning within specification (Joint responsibility, Orbiter and Payload).

Support Requirements for Functional Block 2.5

Facilities

Same as 2.1

Ground Support Equipment

GN_2 Regulating Unit

Hose Set

Service Set, LN_2

Block 2.5.5 (Continued)

Support

Personnel

Technicians

Q.C.

Safety

Engineers

Logistics

Transportation

Warehousing

Procedures

This function ends with the Orbiter/Payload ready to prepare for transfer to the VAB.

Scenario: Activity 3.0 Prelaunch and Launch Operations

All payload operations are covered in this activity from tow of orbiter to VAB, mating orbiter in VAB, and preparations at PAD until liftoff. During these periods this activity is concerned with payload monitoring, launch readiness verification interface checks and final servicing prior to launch.

Block 3.1 Monitor Payload

After completion of payload final closeout in OPF this activity begins and ends with MLP hard mounted at PAD. During this period the payload status, LN$_2$/GN$_2$ and power systems, are continously monitored. The monitoring requirement exists through all activities up to shuttle liftoff, so that the payload integrity is not affected in any way in which it would affect its performance during orbit.

Block 3.1.1 Monitor Payload Status

While in tow until MLP on hardmounts at PAD, the payload power system, purge requirements and LN$_2$ loaded on board the payload experiments are monitored.

Facility Requirements

- o Data Processing - via Orbiter Ground Link
- o Power - 110VAC, 60Hz, 1KW/110VAC, 400Hz, 3Ø, 1KW

Support Requirements

- o None

Block 3.1.1.2 Payload Status Anomally

During this activity an anomally could be loss of power, which would result in payload monitoring capabilities. The loss of GNZ purge which would affect the payload status. Lastly, an LN$_2$ problem which could also affect the payload status conditions.

Facility Requirements

- o Data Processing - via Orbiter Ground Link
- o Power - 110VAC, 60Hz, 1KW/110VAC, 400Hz, 3Ø, 1KW

Support Requirements

- o None

Block 3.1.1.3 Isolate Anomally

The technician monitoring payload would have to observe conditions, and try to isolate problem to a particular system

Facility Requirements

- o Data Processing - via Orbiter Ground Link
- o Power - 110VAC, 60Hz, 1KW/110VAC, 400Hz, 3Ø, 1KW

Support Requirements

- o None

Block 3.1.1.4 Troubleshoot and Repair

When in tow, the technician/engineer will determine course of action to troubleshoot after the MLP is hardmounted at PAD. At that time the technician/engineer will proceed to troubleshoot and repair anomally.

Facility Requirements

- o Data Processing - via Orbiter Ground Link
- o Power - 110VAC, 60Hz, 1KW/110VAC, 400Hz, 3Ø, 1KW

Support Requirements

- o None

Block 3.1.1.5 Verify System

Upon completion of repair of system, a verification test would be performed to verify system functions as required to maintain integrity of payload.

Facility Requirements

- o Data Processing - via Orbiter Ground Link
- o Power - 110VAC, 60Hz, 1KW/110VAC, 400Hz, 3Ø, 1KW

Support Requirements

- o None

Block 3.1.2 Payload Status Monitoring

A continous effort until liftoff to observe payload monitoring requirements function as required to maintain integrity of payload.

Block 3.1.2 (continued)

Facility Requirements

- o Data Processing - via Orbiter Ground Link
- o Power - 110VAC, 60Hz, 1KW/110VAC, 400Hz, 3ϕ, 1KW

Support Requirements

- o None

Block 3.2 Launch Readiness Verification

Begins with arrival at MLP at launch pad and MLP hard down on PAD mounts, and ends with cabin hatch in closed position. During this period the payload will be monitored, as in Activity 3.1, the launch readiness payload verification checks will be performed, film loaded on orbiter for mission and the LNZ system top-off performed, if required.

Block 3.2.1 Payload Status Verification

After arrival at PAD, access to the Orbiter payload Specialist Station to perform an orbiter to payload interface verification. The verification would check the operational capabilities of the controls and switches required to operate the payloads on-orbit.

Facility Requirements

- o Data Processing - via Orbiter Ground Link
- o Power - 110VAC, 60HZ, 1KW
- o Monitoring - LPS
- o Fluids - GNZ

Support Requirements

- o None

Block 3.2.1.1 Payload Status Anomally

During verification an anomally could appear which could jeapardize the mission. The anomally could be lack of control or switches in OPSS for operation of payload/experiments, or the data processing/recording system are inoperative due to interface problem or equipment failure.

Block 3.2.1.1 (continued)

Whatever the anomally we would proceed to resolve anomally prior to liftoff.

Facility Requirements

- Data Processing - via Orbiter Ground Link
- Power - 110VAC, 60 HZ, TBD(KW)/110VAC, 400Hz, 3Ø, TBD(KW)
- Monitoring - LPS
- Fluids - GN_2

Support Requirements

- None

Block 3.2.1.2 Isolate Anomally

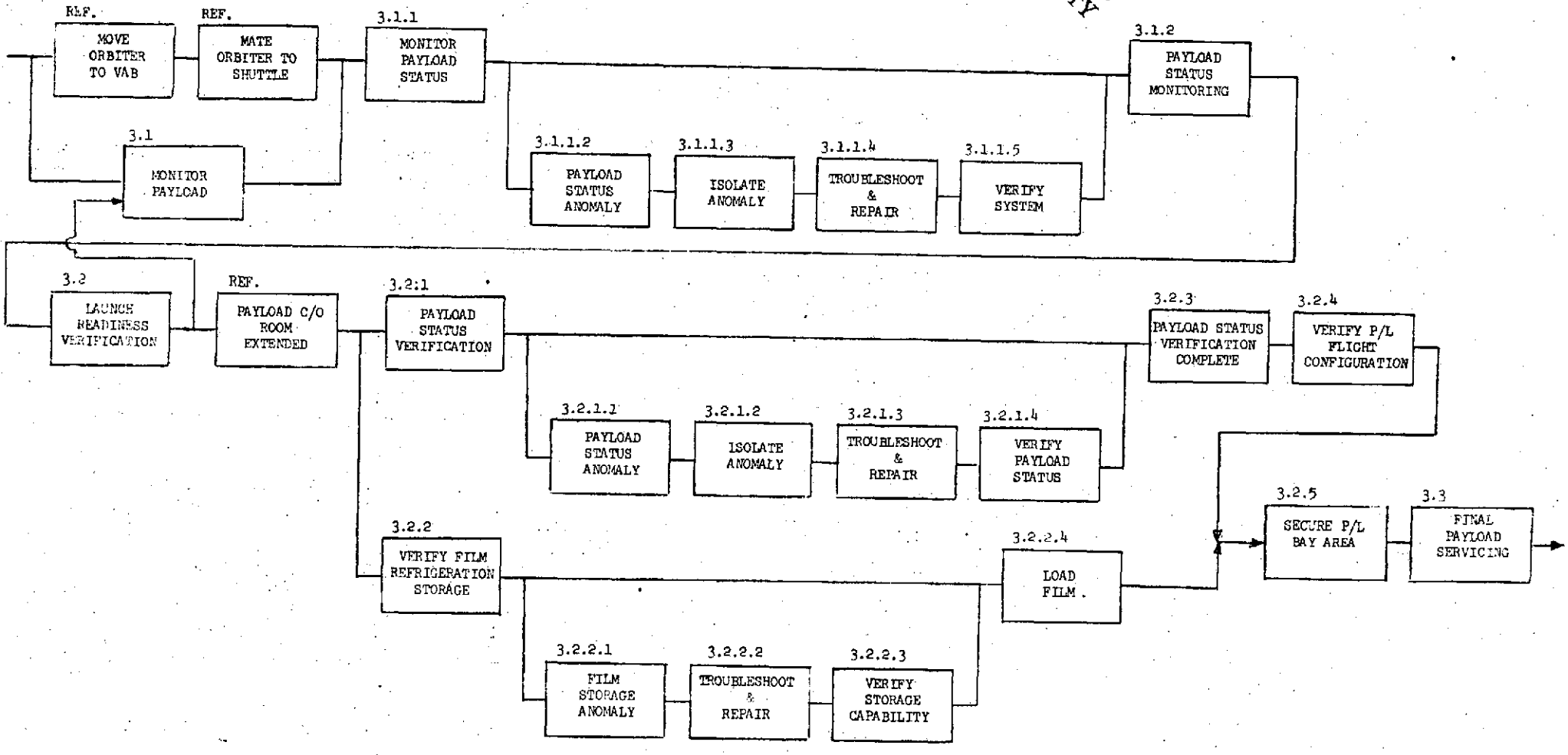
The technicians/engineers performing the verification checks would isolate the anomally to either Ground Support Equipment, Payload/Experiment or Orbiter Systems. After the anomally has been isolated a typical approach to resolution of problem is shown on Figure 3-1. The GSE/Payload/Experiment - Off-Line maintenance would be performed by experimenter. Orbiter Systems maintenance resolution would be KSC responsibility. ~~The typical flow for Orbiter Maintenance (Figure) does not dictate, but does give a general approach for resolution of anomally.~~

Facility Requirements

- Data Processing - via Orbiter Ground Link
- Power - 110 VAC, 60 HZ, TBD(KW)/110VAC, 400Hz, 3Ø, TBD(KW)
- Monitoring - LPS
- Fluids - GN_2

Support Requirements

- None



ACTIVITIES 3.1 MONITOR PAYLOAD AND 3.2 LAUNCH READINESS VERIFICATION

FIGURE 3.1

Block 3.2.1.3 Troubleshoot and Repair

A typical approach is shown on Figure 3.1.

Facility Requirements

- o Clean lab
- o Calibration
- o Radiological lab
- o Machine lab
- o Mech. lab
- o Elect. lab

Support Requirements

- o Transportation
- o X-Ray

Block 3.2.1.4 Verify Payload Status - Off line

After the resolution of the payload/experiment/GSE anomally a verification check would be made prior to installation in payload bay to show that is can now support the defined performance requirements of the mission.

Facility Requirements

- o Clean lab
- o Calibration lab
- o Radiological lab
- o Machine lab
- o Mech lab
- o Elect. lab

Support Requirements

- o GSE - TBD
- o Special test equipment - TBD
- o Transportation

Block 3.2.2 Verify Film Refrigeration Storage

A verification check is performed to check refrigeration system for proper cooling requirements prior to loading film on experiments in payload bay.

Facility Requirements

- o Power - Orbiter power for refrigeration unit

Support Requirements

- o None

Block 3.2.2.1 Film Storage Anomally

Return film to storage area until refrigerant anomally is resolved.

Facility Requirements

- o Power - Orbiter power for refrigeration unit.

Support Requirements

- o Transportation

Block 3.2.2.2 Troubleshoot and Repair

A typical approach is shown on Figure 3.1

Facility Requirements

- o Mech. lab - if off line.
- o Elect. lab - if off line.
- o Power - Orbiter power for refrigeration unit, if at PAD

Support Requirements

- o Transportation

Block 3.2.2.3 Verify Storage Capability

After resolution of refrigerant anomally verify the refrigeration unit is ready for film storage.

Facility Requirements

- o Power - Orbiter power for refrigeration unit

Block 3.2.2.3 Verify Storage Capability (cont.)

Support Requirements

- o None

Block 3.2.2.4 Load Film

The verification check of the refrigeration unit was performed with no problems, and if an anomally did occur it has since been resolved and the film can now be placed on-board the orbiter.

Facility Requirements

- o Power - Orbiter power for refrigeration unit

Support Requirements

- o None

Block 3.2.3 Payload Status Verification Complete

The verification check was performed with no problems, and if an anomally did occur it has since been resolved and the payload is ready for flight.

Facility Requirements

- o Data Processing - via Orbiter Ground link
- o Power - 110 VAC, 60 HZ, TBD(KW)/110VAC, 400Hz, 3Ø, TBD(KW)
- o Monitoring - LPS
- o Fluids - GN_2

Block 3.2.4 Verify Payload Flight Configuration

Prior to securing OBSS and payload bay a check is made to verify that all experiments, controls, switches, etc. are in flight readiness configuration.

Facility Requirements

- o Data Processing - via Orbiter Ground link
- o Power - 110 AC, 60 HZ, TBD(KW)/110VAC, 400Hz, 3Ø, TBD(KW)
- o Monitoring - LPS
- o Fluids - GN_2

Block 3.2.4 (cont.)

Support Requirements

- o None

Block 3.2.5 Secure Payload Bay Area

Secure all PPE used in verification checks between OPSS and payload.

Facility Requirements

- o None

Support Requirements

- o TBD

Block 3.3 Payload Final Servicing

During this period the payload will be monitored, as in Activity 3-1 through liftoff. The payload final servicing will start T0-6 hrs. when access is required to payload bay through the payload changeout room. At this time the LN_2 system will be monitored to determine if LN_2 top-off is required. In parallel off-line support the LN_2 dewars will be prepared for servicing, so as to be ready if LN_2 top-off is required. After top-off, the payload/orbiter will be secured and the orbiter shuttle will proceed with countdown and liftoff.

Block 3.3.1 Verify Payload LN_2 system

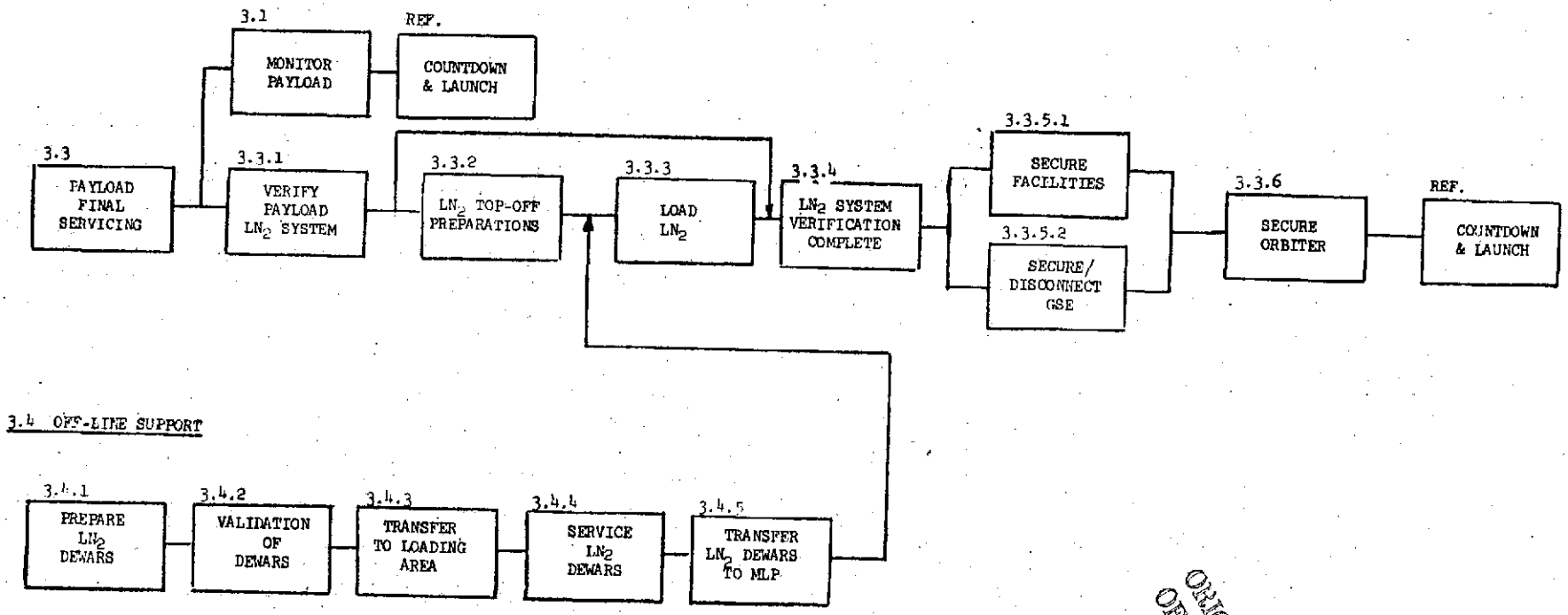
Access is required through payload changeout room to payload bay at T0-6 hours to monitor LN_2 system to determine if LN_2 system needs top-off.

Facility Requirements

- o Fluids - LN_2, GN_2
- o Power - 110 VAC, 60 HZ, TBD(KW)/110VAC, 400Hz, 3Ø, TBD(KW)
- o Data Processing - via Orbiter Ground link
- o Monitoring - LPS

Support Requirements

- o None



ACTIVITY 3.3 FINAL PAYLOAD SERVICING

Block 3.3.2 LN_2 Top-Off Preparations

Install/connect GSE servicing equipment to payload in preparation for loading LN_2.

Facility Requirements

- o Payload changeout room
- o Power - TBD

Support Requirements

- o None

Block 3.3.3 Load LN_2

With the arrival of the LN_2 dewars, connect the dewars to servicing GSE and proceed to load LN_2.

Facility Requirements

- o Monitoring - LPS
- o Data Processing - via Orbiter Ground link
- o Power - 110 VAC, 60 HZ, TBD(KW)
- o Fluids - LN_2

Support Requirements

- o Safety

Block 3.3.4 LN_2 System Verification Complete

The LN_2 System monitoring check was performed, and if top-off was required the LN_2 system is now ready to perform its mission in orbit.

Facility Requirements

- o Monitoring - LPS
- o Data Processing - via Orbiter Ground link
- o Power - 110 VAC, 60 HZ, TBD(KW)

Support Requirements

- o None

Block 3.3.5.1 Secure Facilities

Secure all facilities on MLP in support of payload monitoring, verification checks and servicing.

Facility Requirements

- o None

Support Requirements

- o None

Block 3.3.5.2 Secure/Disconnect GSE

Secure/disconnect all GSE on MLP, Payload Changeout Room, used in support of payload monitoring, verification checks and servicing.

Facility Requirements

- o None

Support Requirements

- o Transportation -TBD
- o Safety

Block 3.3.6 Secure Orbiter

Payload bay, payload/experiments are now completely secured and Launch Operations can proceed toward countdown and lift-off.

Facility Requirements

- o None

Support Requirements

- o None

Block 3.4 Off-Line Support

Off-line Support is any activity required for support of verification, servicing, monitoring, etc. that will be used to support the processing of the payload through Launch Operations.

Block 3.4.1 Prep. LN_2 Dewars

The preparations is an off-line activity for top-off of LN_2 on payload at TO-6 hours.

Block 3.4.1 (cont.)

Includes disassembly/assembly of dewars for cleaning, calibration and proofing of hoses.

Facility Requirements

- o Mech. lab with laminar flow bench
- o Clean lab
- o Calibration lab

Support Requirements

- o Transportation - TBD

Block 3.4.2 Validation of Dewars

Functional test of dewars prior to servicing.

Facility Requirements

- o Mech. lab
- o Power - TBD
- o Fluids - GN_2, LN_2

Support Requirements

- o None

Block 3.4.3 Transferring dewars to area for LNZ loading

Facility Requirements

- o None

Support Requirements

- o Transportation - TBD

Block 3.4.4 Service LN_2 Dewars

Configure LN_2 dewars, load, and verify dewars are ready to support top-off of payload experiment.

Block 3.4.4 (cont.)

Facility Requirements

- o Fluids - LN_2
- o Power - TBD

Support Requirements

- o None

Block 3.4.5 Transfer LN_2 Dewars to MLP

Upon completion of servicing transfer LN_2 dewars to MLP to support top-off of payload/experiment.

Facility Requirements

- o None

Support Requirements

- o Transportation - TBD

Block 3.5.6 Typical Off-Line Maintenance - Experiment/Payload/GSE

The off-line maintenance for experiment, payload, and GSE in direct support of the experiment is the responsibility of the experimenters. The maintenance is performed in the support facilities, required for trouble-shooting, repair and verification, as defined in Facilities Requirements for their particular experiment/payload/GSE. A typical off-line maintenance flow is shown in Figure 3.3.

Block 3.5.6.1 Transfer to Repair Facility

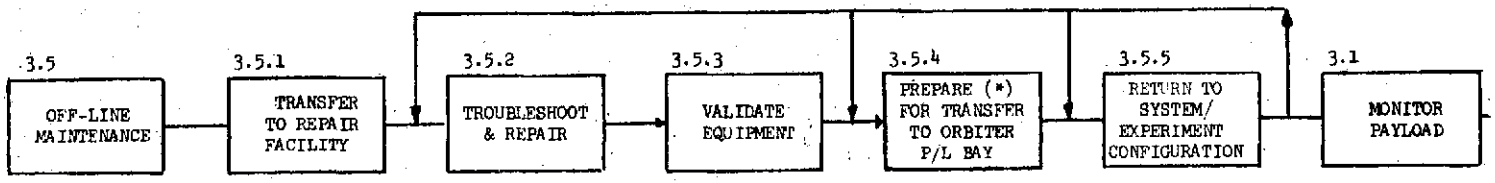
Initial step in off-line maintenance is to transfer experiment/payload/GSE to specific facility required to support maintenance of anomaly.

- o Facility Requirements
  - Film Lab
  - Clean Lab
  - Calibration Lab
  - X-Ray
  - Elect. Lab
  - Machine Shop
  - Mech. Lab.
- o Support Requirements
  - Transportation
  - Handling Fixtures

Block 3.5.6.2 Trouble-Shoot and Repair

Perform all steps necessary for trouble-shooting and repair of experiment/payload/GSE anomaly.

- o Facility Requirements
  - Cleaning Lab.
  - Calibration Lab.
  - Film Lab.
  - X-Ray



TYPICAL EXPERIMENT/PAYLOAD/GSE - OFF-LINE MAINTENANCE FLOW

- o Support Requirements

  Logistics Spares

Block 3.6.3 Validate Equipment

Performance of test to verify anomaly has been repaired and experiment/ payload/ GSE is ready to support mission.

- o Facility Requirements

  Power - TBD

  Fluids - TBD

  Gases - TBD

- o Support Requirements

  Test Equipment - TBD

  Support GSE - TBD

Block 3.6.4 Prep.(*GSE) for Transfer to Orbiter Payload Bay.

Perform all steps necessary to prep.* experiment, payload/GSE for transfer back to Orbiter Payload Bay, while still maintaining integrity of experiment.

- o Facility Requirements

  Power - TBD

  Fluids - TBD

  Gas - TBD

- o Support Requirements

  Transportation

  Handling Fixtures

Block 3.6.5 Return to System/Experiment Configuration

Reinstall experiment payload, GSE back to configuration to support mission. Verify electrical/mechanical interfaces as required, and verify mission support capabilities of system.

- o Facility Requirements

  Power - TBD

  Fluids - TBD

Gas - TBD

Data Processing

Monitoring - LPS

- o Support Requirements

TBD

Block 3.6 ~~Typical~~ - Payload/Orbiter - Maintenance ~~Flow~~.

The Orbiter Support System for Payloads are Orbiter (KSC) responsibility. If an anomaly occurs between the interfaces, such as in the Data Processing System or Environmental System, the appropriate Orbiter (KSC) representative would be notified and KSC would proceed with resolving anomaly. After resolution, interfaces would be verified to determine if now payload is ready to support its mission in orbit.

- o Facility Requirements

KSC Responsibility

- o Support Requirements

KSC Responsibility

Scenario - Activity

Block 4.0 Post Landing Operations

With the Orbiter hard mounted in the OPF, the Orbiter Support Systems are switched to facility services and preparation for safing and removal of payload elements begins. Safing completed, the time critical items are removed, and the GSE processing for removal of payload doors and payload proceed until payload is securely mounted on transporter and is transported to the Payload Post-Mission Processing Area.

Block 4.1 Switch to Facility Services and Safe Payload

The Orbiter Support Systems are switched to facility services; such as, power, cooling and instrumentation. Purge and Dry Payload elements (as applicable) commences until payload is environmentally safe for personnel access. The switch over to Payload Ground Monitoring, if applicable, is also verified during this activity.

Block 4.1.1 Payload Support System Verification

The payload bay area has been pruged and the change over to facilities for power, cooling, instrumentation for ground monitoring has been completed and verified operational.

Facility Requirements
Power - 110VAC, 60Hz, 2KW
Fluids - GN_2

Support Requirements

None.

Block 4.1.2 Payload Environment Safe

A verification by safety that the payload area is environmental safe for personnel access.

Facility Requirements
Power - 110VAC, 60Hz, 2KW
Fluids - GN_2

Support Requirements

Safety.

Block 4.2 Remove Time Critical Flight Experiments

The payload bay area safe for access, the experimenters can perform the tasks necessary for the removal of time critical flight experiments; such as, film.

Block 4.2.1 Place Items in Applicable Containers/Carriers

Upon access to payload, the experimenters remove the time critical flight experiments; such as, film, and place them in applicable containers/carriers.

Facility Requirements

Power - 110 VAC, 60Hz, 2KW

Support Requirements

None.

Block 4.2.2 Remove from Orbiter Payload Bay

The Time Critical Flight Experiments are ready for removal from Orbiter Payload Bay, and are transferred to the appropriate processing area.

Facility Requirements

Power - 110 VAC, 60Hz, 2KW

Support Requirements

Transportation

Dark Room

Block 4.3 Open Payload Bay Doors and Install Payload GSE

After the thermal protection system, the Payload Bay Doors are removed and the manipulator arm deployed, the experimenter is responsible for installation of payload bay access stands.

Block 4.3.1 Install Payload Bay Access Stands

The experimenter install payload access stands, as required for removal of payload from Orbiter Payload Bay.

Facility Requirements

Power - 110 VAC, 60Hz, 2KW

Support Requirements

None

Block 4.4 Remove Payload

The removal of Payload includes all the tasks; such as, attaching payload handling GSE, demating of the Payload/Orbiter interfaces, the removal of access stands, and finally the removal from payload bay and placement on payload transporter/handling fixture.

Block 4.4.1 Attach Payload Handling GSE

The Payload Handling GSE; such as, slings are now moved into place and connected to lifting points on payload.

Facility Requirements

Power - 110 VAC, 60Hz, 2KW

Crane - 15000 lbs. capability

Support Requirements

None.

Block 4.4.2 Demate Payload/Orbiter Interfaces

The Payload/Orbiter Interfaces are disconnected and the payload is inspected for approval for removal from Orbiter.

Facility Requirements

Power - 110 VAC, 60Hz, 2KW

Crane - 15000 lbs.

Support Requirements

None.

Block 4.4.3 Remove Access Stands from Payload Bay

The experimenters remove the access stands in order to clear the payload bay area for removal of payload.

Facility Requirements

None

Support Requirements

None.

Block 4.4.4 Remove Payload from Payload Bay

The Payload is lifted from the payload bay and installed/mounted on the payload transporter/handling fixture.

Facility Requirements

Power - 110 VAC, 60Hz, 2KW

Crane - 15,000 lbs.

Support Requirements

Safety.

Block 4.5 Move Payload to Post Mission Processing Area

After payload is installed/mounted on transporter verify payload monitoring system is operating, if applicalbe, and payload is secure and proceed with transfer to Post Mission Processing Area.

Block 4.5.1 Verify Payload Secure on Transporter

Experimenter verifies payload monitoring system is operational, and payload is securely mounted on transporter.

Facility Requirements

Crane - 15,000 lbs.

Support Requirements

None.

Block 4.5.2 Move Payload to Post Mission Processing Area

With payload secure in transporter, proceed to Post Mission Processing Area.

Facility Requirements

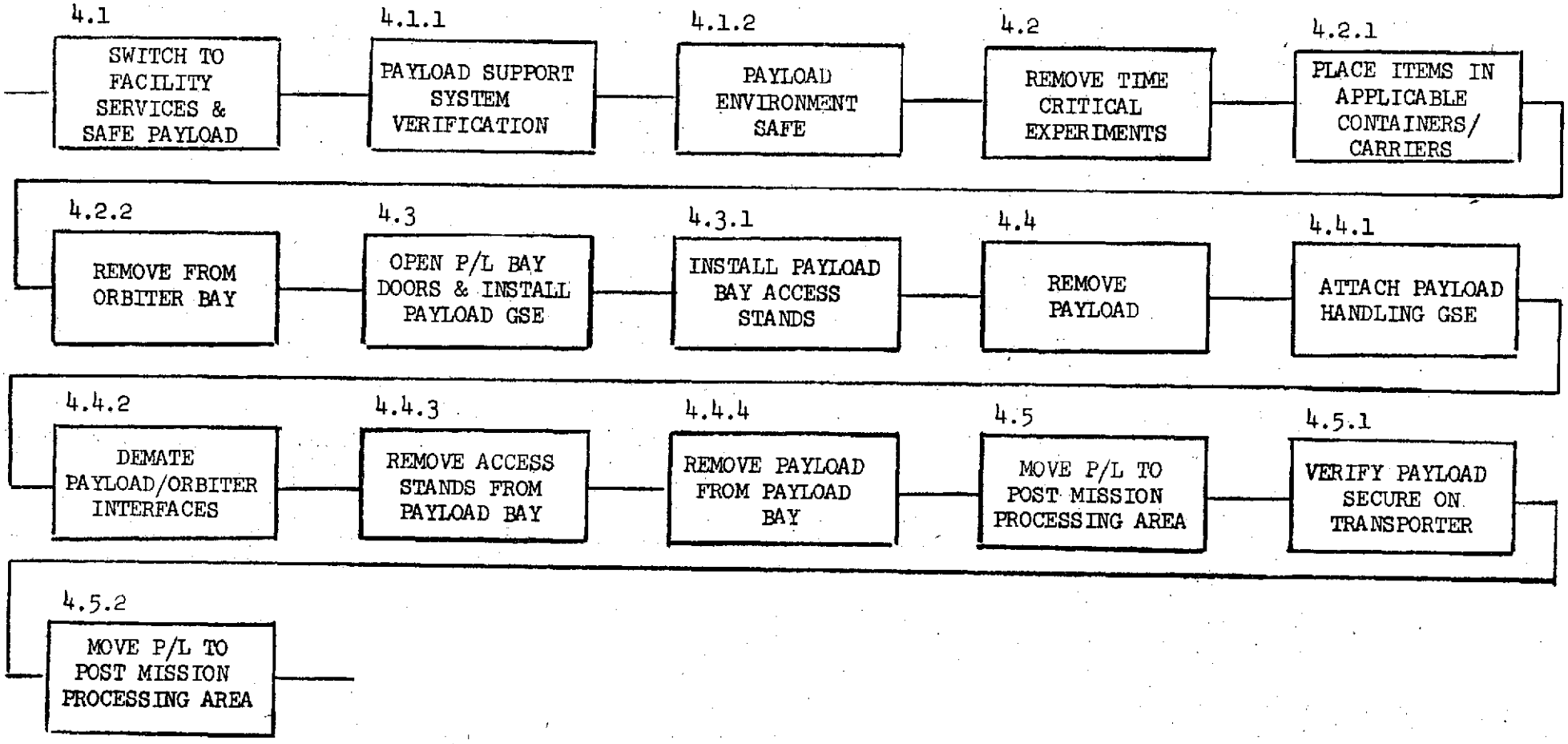
None.

Support Requirements

Transportation - Tractor

Security

Safety



BLOCK 4.0 POST LANDING OPERATIONS

Block 5.0 Post Mission Processing - Mission #13

The activities contained within this functional block defines the processing required following flight and prepares the various payload elements for return to their post mission sites. Figure 2.5-1 graphically depicts this flow.

The vollowing assumptions were made in defining this flow:

- o Vehicle has been safed and verified.
- o All pressures have been vented to nominal values.
- o All lines have been purged, padded, and capped.
- o All exposed electrical connectors have been capped.
- o All other activity in Functional Block 4.0 has been completed.

Block 5.1 Inspect Payload

Conditions The pallets with their experiments have been delivered to the Premission Processing Facility and wiped down in the airlock.

Block 5.1.1 Position payload and access GSE in the proper area.

Block 5.1.2 Remove all protective covers and/or panels to gain visual access to all payload elements.

Block 5.1.3 Visually inspect all payload elements for physical damage and document the discrepancy.

Block 5.1.4 Remove any remaining flight data and deliver to the proper agency.

Block 5.1.5 Clean payload elements as required.

Support Requirements for Functional Block 5.1

Facilities

Floor space 2700 sq. ft. (90 x 30)

O/H crane 4 ton capacity

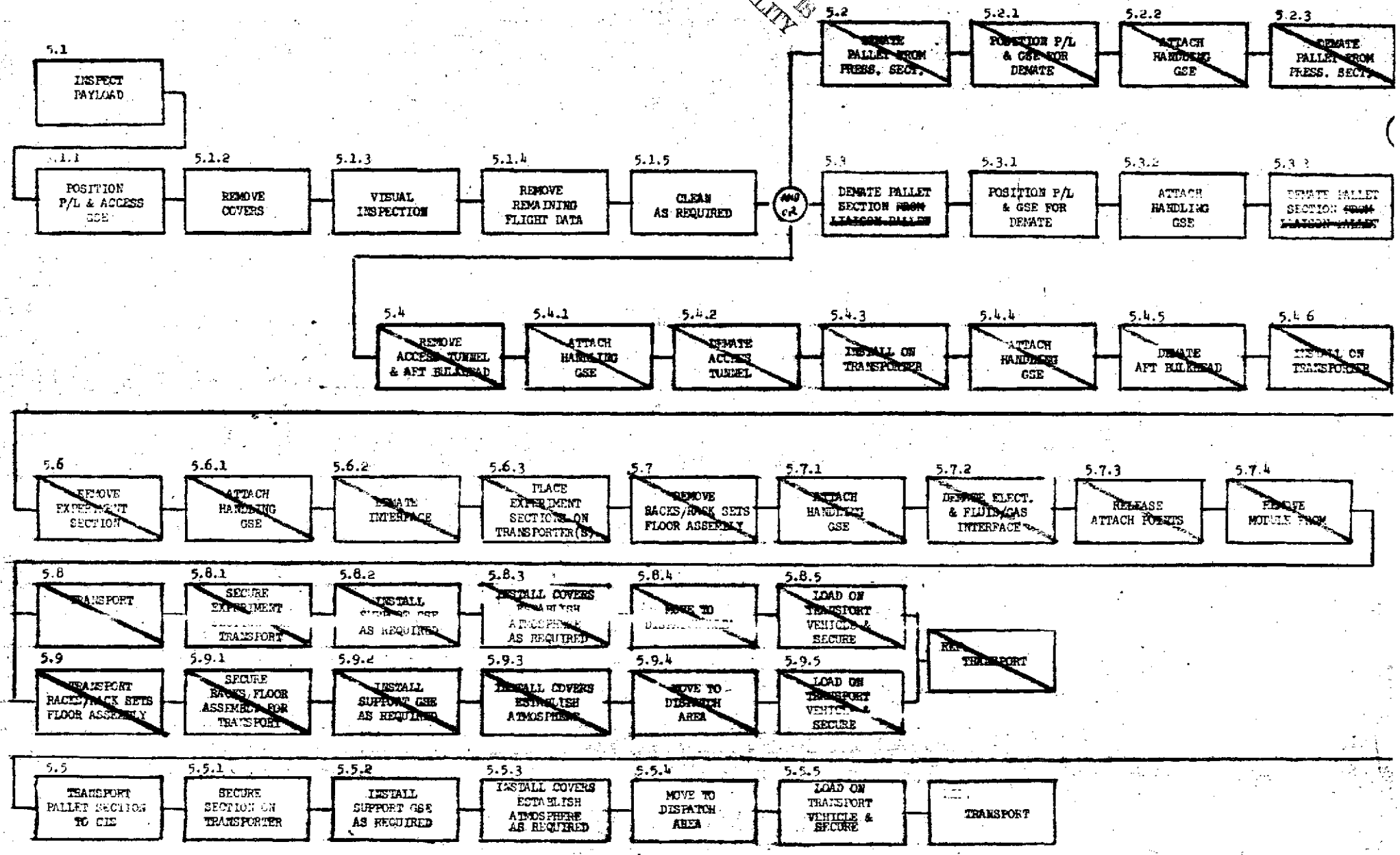
GN_2

Ground Support Equipment

Access stand, set

GN_2 regulating unit

FIGURE 2.5-1 POST MISSION PROCESSING MISSION #13



Block 5.1.5 (Continued)

Ground Support Equipment (Continued)

Handling equipment, covers/panels

Support

Crane operator

Personnel

Technicians

Q.C.

Safety

Engineers

Logistics

Procedures

Block 5.3 Demate Pallet Sections

Conditions Post mission cleaning and inspection has been completed.

Block 5.3.1 Position pallets and GSE for demating.

Block 5.3.2 Attach handling GSE to pallet #1

Note: Pallet #1 contains the Igloo and forward utility bridge (cantilevered from the front face). Utilize caution in demating from the other pallet sections.

Block 5.3.2.1 Demate all interface connections between pallets #1 and #2. Cap all lines and plugs.

Block 5.3.3 Demate pallet #1 from pallet #2.

Repeat steps 5.3.1 through 5.3.3 for remaining pallet sections.

Note: Exact procedures of the demate operation will depend on detail design of the transporter used to move the payload from the OPF to the PPF. As an example, the transporter may be modular, with each pallet section on its own cradle/dolly. If this is the case, the demate operation would involve merely horizontal movement of the pallet/dolly to affect separation.

Support Requirements for Functional Block 5.3

Same as 5.1

Block 5.5 Transport Pallet Sections to CIS

Conditions Pallets have been demated and are ready for transport.

Block 5.5.1 Secure pallet section(s) on transporter(s).

Block 5.5.2 Install supporting transporter GSE.

Block 5.5.3 Install cover(s), purge and establish proper atmosphere for transport.

Block 5.5.4 Move transporter(s) with pallet section(s) to shipping area.

Block 5.5.5 Load on transport vehicle tie down and secure. Verify all monitoring devices operational.

Support Requirements for Functional Block 5.5

Same as 5.1 plus transport covers, tow vehicle and operator.

Shipping area TBD

DEDICATED SOLAR SORTIE MISSION (DSSM)

SO-01-S

Difference Between

Launch Site Facility Requirements Data Sheet (Functional)

(Revision A - dated 8/31 74)

and

GAC Data

The differences in launch site requirements are included in the following pages. The Data Sheet information is shown in parenthesis and followed by GAC data and logic basis. Requirements solely generated by GAC and not reflected in the Data Sheets have not been duplicated.

Block 1.0 Payload Premission Processing

Block 1.8 Receiving and Inspection

A. Experiment/Payload Area Requirements

Length(ft)	Width(ft)	Min Height(ft)
(45)	(15)	(60)

o 72 ft. long (CBS - 60 ft., end clearance 6 ft. both ends), 41 ft. wide (shipping container - 11 ft., CBS - 18 ft. side clearance 6 ft. both sides), height 30 ft. (trailer and shipping container - 16 ft., pallet segment and clearance - 14 ft.).

TEMP (°K)

(290 ± 4) (62° ± 8)

o Level B data contains the following:

- Data Sheet #S-23; Receiving Facility temperature 290 ± 4K.
- Data Sheets S-24a and 24b - Ground Environmental Limits - non-operating minimum of 255°K (0°F) and maximum of 325 K (120°F).

Assuming the receiving and inspection area of the PPF will be routinely heated and air conditioned, the 290 ± 4K requirement is deleted, and the conclusion reached that the DSSM imposes no temperature requirements for the receive and inspect function.

RELATIVE HUMIDITY (%)

(30 to 60)

o Level B data contains the following:

- Data Sheet #S-23; Receiving Facility relative humidity 30 to 60%.
- Data Sheets #S-24a and S-24b; non-operating maximum relative humidity as 25%.

These requirements involve high cost moisture removal equipment. It is understood that humidity is maintained about 50% (±10) in the high bay area of the O&C Building.

It is recommended that the DSSM relative humidity requirement be investigated, with the objective to raise it to the 50%(±10) level.

1.8 (continued)

B. Fluids

MEDIA (GN_2)

PRESS (PSIG) (3500)

FLOW RATE (10 c.f.m.)

TOTAL VOLUME (7200 ft.^{3})

TEMP (°K) (290 ± 4)

CLEANLINESS SPEC (< 5000)

o Level B data lists the following:

- Data Sheet #S-9 (In-flight, non-operating) - Equipments 001, 002, and 003 require nitrogen for film; 004, 005, 020, 007, 008, and 009 require GN_2 for purge on pad during entry, landing, and post landing. Equipment 015 requires GN_2, purpose unstated.
- Data Sheet #S-10a and b (In-flight, operating) - No requirements for nitrogen.
- Data Sheet #S-11a and b (In-flight Contamination Control Criteria) - generally, reflects same data as Data Sheet #S-9 above.
- Data Sheet #S-22 (Launch/Land Support Requirements) - for Launch Pad/Lift-off, GN_2 purge line 2 cu. m/hr (about 1.18 ft.^{3}/min) required, equipment to be provided by Pad.
- Data Sheet #S-23 (Ground Facility Requirements) - for the Supply Shipping and Receiving Facility at the launch site GN_2 is listed as a utility requirement.
- It is felt that the above Level B data is too broad to define a specific fluid requirement for Block 1.8 - Receiving and Inspection - activities. It is recommended that the fluid requirement be listed a TBD at this time, and effort be made to obtain definitive purging requirements of the instruments during transportation, when in storage in their shipping containers, and when removed from their shipping containers in a 100K clean

B. Fluids (continued)

environment (high bay area of PPF). When these instruments requirements are adequately defined, the launch site support and facility requirements for fluids for DSSM may be determined.

C. Special Handling

(Crane and Transporter - 17 ton)

- Crane capacity of 10,000 lbs. The Study processes individual pallets upon which are mounted the experiments. The heaviest pallet contains experiments 002, 007, and 008. The weight of the pallet plus its shipping container is estimated to be about 6,500 lbs.
- For a "Transporter", the Study uses the concept of a Cargo Bay Simulator which serves the purpose of transporting the DSSM at the launch site.

D. Payload Peculiar Equipment

(400 sq. ft.)

- 20 ft. long, 16 ft. wide, 4 ft. high which provides space for two of five GSE racks estimated to support the DSSM for activities in the PPF. The receive/inspection function is considered by the Study to be performed in series; therefore, area for all five GSE racks at one time is not required.

Block 1.11 Mate Pallet, Reassemble and Checkout

A. Experiment/Payload Area Requirements

(Data same as Block 1.8 above)

- Block 1.11 is defined as mating pallet sections with liaison pallet which the Study considered not applicable to the DSSM flight. Block 1.10 in Study verifies individual pallet interfaces, installs pallets into Cargo Bay Simulator, and verifies end-to-end installed pallet interfaces in preparation of next activity (Block 1.12 - Connect Orbiter Simulator). Study Block 1.10 is assumed to be same as Block 1.11 above for the purposes of Data Sheet evaluation.

Block 1.11

A. Experiment/Payload Area Requirements (continued)

o PPF Checkout Area

- 80 ft. long, 35 ft. wide, 39 ft. high for Cargo Bay Simulator, work stands, and clearances.
- 15 ft. long, 10 ft. wide, 18 ft. high for pallet segments.
- 12 ft. long, 8 ft. wide, 4 ft. high for DSSM GSE.

o For TEMP(°K), RELATIVE HUMIDITY(%), and CLEANLINESS CLASS:

Refer to paragraphs in Block 1.8 above.

B. Fluids

MEDIA (LN_2)

PRESS(PSIG) (30)

FLOW RATE (1 lb/min)

TOTAL VOL (220 lbs.)

CLEANLINESS (N/A)

o Level B data lists the following:

- Data Sheet #S-25 (Payload Safety Analysis) shows experiments 011, 013, and 014 use cryogenic nitrogen.
- Data Sheet #S-24a (Ground Environmental Limits) shows non-operating min/max temperature of these three experiments to be TBD, with operating temperature being min = 292°K(64°F) and max = 296°K(72°F).
- Data Sheet #S-23 (Ground Facility Requirements) shows that at the launch site at the Payload Operations and Checkout Facility, utility requirements include LN_2.

The Study lists no LN_2 requirement for the checkout function. The logic follows:

- Interface verification is performed without operating the instruments, using GSE to simulate instrument sensor outputs as required.
- Level B data is too general to establish a firm LN_2 support/facility requirement.

Block 1.11

C. AC Power

VOLTS (AC)	HERTZ	PHASE	POWER(KW)
(115)	(60)	(Single)	(15.0)
(110)	(400)	(3)	(3.0)

- Level B data lists the following:
  - Data Sheets #S-8a and 8b (Experiment equipment - Power and Data) shows VAC = 28, 400 cycles, total stand by power ≐ 90W, operating power = 70W, peak power = 1217 W. These power data are based upon Data Sheet #S-15, the Payload Operational Time Line, Mission Day #3.

    The Study power requirements are TBD at this time. The logic is:

    - Interface verification is performed without operating the instruments, using GSE to simulate instrument sensor outputs as required.
    - DSSM GSE for interface verification tests is not defined, and it is felt that estimated GSE is too general to develop firm launch site electrical support requirements.

Block 1.12 Connect Orbiter Simulator

A. Experiment/Payload Area Requirements

LENGTH (ft)	WIDTH (ft)	MIN HEIGHT (ft)
(45)	(15)	(19)

- 72 ft. long (CBS - 60 ft.; Orbiter Simulator = 12 ft.), 27 ft. wide (CBS = 15; workstands = 6 ft. each side), 18 ft. high (CBS = 18 ft.).
- For TEMP(°K), RELATIVE HUMIDITY (%), and CLEANLINESS CLASS: Refer to paragraphs in Block 1.8 above.

B. Fluids

(Data Sheet requirements same as paragraph Block 1.8B above.)

- GN_2 requirement is TBD at this time. See paragraph Block 1.8B above for logic.

Block 1.12.1 Load and Verify Flight Software

(Data Sheet requirements are VAC=115, Hertz=60, Phase=single, Power(KW)=15, and 600 sq. ft. for Payload Peculiar Equipment.)

- o The Study assumes that flight software verification would be performed by launch site personnel, and therefore no support facility requirement were developed for this activity.

Block 1.13 Final Integrated Systems Test

A. Experiment/Payload Area Requirements

(Data Sheet information same as paragraph Block 1.12A above.)

- o Study data same as Block 1.12A above.

B. Fluids

(Data Sheet information same as paragraph Block 1.8B above.)

- o Study data same as Block 1.8B above.

C. AC Power

(Data Sheet information same as paragraph Block 1.11C above.)

- o Study data same as Block 1.11C above.

D. Payload Peculiar Equipment

(600 sq. ft.)

- o Study results have no requirements, based upon the assumption that, for the Final Integrated Systems Test, the DSSM GSE would be integrated in the Orbiter Simulator or located on the CBS workstands.

Block 1.14 Service Non-time Critical Items

A. Experiment/Payload Area Requirements

(Data Sheet information same as Blocks 1.11 through 1.13)

B. Fluids

(Data Sheet lists requirements for GN_2 and LN_2.)

C. AC Power

(Data Sheet lists requirement for 115VAC.)

Block 1.14 (continued)

D. Payload Peculiar Equipment

(Data Sheet lists area requirements for 600 sq. ft.)

- o Level B data does not define any non-time critical service requirements. Study lists candidate as GN_2 supply for instrument purging, and lists the GN_2 and electrical power to support the purge as TBD.
- o The LN_2 requirement is considered time-dependent, and its service should be deleted from Block 1.14 requirements.

Block 1.16 Weight and C.G.

(Data Sheet information contains requirements for area, fluids, power, and special handling.)

- o The Study baseline Sortie Payload Functional Flow does not contain a Weight and C.G. activity block, therefore, no requirements for this activity were considered in the Study. However, if the Weight and C.G. test is to be performed, it is felt that the test would be conducted by launch site personnel, and would not involve experiment-related requirements.

Block 1.17 Move to OPF

(Data Sheet information similar to Block 1.8 except height reduced from 60 to 19 ft., GN_2 supplied by portable source, and 115VAC required.)

- o Study requirements are:

A. Area

The Study uses the concept of a Cargo Bay Simulator (CBS) which is 60 ft. in length vice 45 ft. length of Data Sheet.

B. Fluids

Study indicates a supply of GN_2 is a candidate requirement. See paragraph Block 1.8B above.

Block 1.17 (continued)

C. AC Power

Study does not identify a requirement for 115VAC during the move from PPF to OPF. Level B Data, Data Sheet #S-20 (Launch/Land Support Requirements) lists a monitoring requirement to start 48 hours prior to launch via Orbiter ground link; however, this requirement would not appear to be valid for Block 1.17 activity.

2.0 Orbiter/Payload Mate and Integrate (Dedicated Solar Sortie Mission DSSM).

2.1 Install Payload in Orbiter Payload Bay

o Area Requirements (45'L x 15'W x 60'H)

Given the DSSM dimensions of 44.94'L x 14'W x 10'H, the area listed would provide space for the bare payload only, adding area for stands and access (4'W stands, 6' wide aisle) plus area for benches, rollarounds etc. (10' aft of payload) the GAC recommendation would be an area 75'L x 34'W. The listed hook height is adequate.

o Environment: 2.1 through 2.5

With respect to environmental conditions, the flagged note ⚠1 refers to MIL-STD 1246A which is a product cleanliness spec. Fed. Std 209a covers area environment. It is recommended that reference to note ⚠1 be deleted from the area requirements column.

o Fluid Requirements: 2.1 through 2.5

Volume given in Function 2.1 should read 4800 ft^3 (10 $ft^3/_m$ for 480 minutes), function 2.2 should read 2400 ft^3 (10 $ft^3/_m$ for 240 minutes). Also, during function 2.4 Orbiter Integrated Test, LN_2 may be required, and could be supplied by portable dewars.

o Power Requirements: 2.1 through 2.5

(115 VAC, 60 Hz, 1Ø, 2.0 KW)

(110 VAC, 400 Hz, 3Ø, 2.0 KW)

General note 1 on the Requirements Data Sheet notes the purge monitor continuous through these functions, assuming the listed power is for the monitoring function only, additional power may be required during OIT. SSPD data sheets S-8A and S-8b indicate requirements for 28 VAC at 400 Hz, however, data sheets S-7a-7c show 115 VAC at 400 Hz. Resolution between this variance must be made before rigid power requirements can be established.

2.1 (Continued)

o Special Handling: 2.1

(Crane, Transporter 17 ton capability)

Level B data lists the payload weight at 5619 kg, the ERNO Space Lab description (June 1974) gives maximum pallet weight at 4670 kg. Total weight would be 5619 + 4670 = 10,289 kg or 22,687 pounds. A 12 ton crane would be adequate.

There are no other changes recommended.

LAUNCH SITE FACILITY REQUIREMENTS DATA SHEET (FUNCTIONAL)

Block 3.0 Prelaunch and Launch Operations

Block 3.1 Monitor Payload

A. Experiment/Payload Area Requirements

- o Relative Humidity (%)

  (25%)

  The requirement should be changed from 25% to 30-60% in payload area. Reason - The experiments 50-001 through 50-009 and 50-055 have protective covers provided to maintain 25% humidity MIL-STD1246.

- o Cleanliness Class

  (Better than 5000 class)

  Cleanliness Class should be changed to 100,000. Reason - The experiments 50-001 through 50-009 and 50-055 have protective covers provided to maintain better than 5000 class. MIL-STD1246A, TABLE 1A-25.

B. Fluids

- o Cleanliness Specification

  (Better than 5000)

  GN_2 Cleanliness Class - better than 5000 is only required for experiments 50-001 through 50-009 and 50-055 for purging to prevent contamination. The other experiments have a cleanliness requirement of 100,000.

- o Media

  (GN_2/LN_2)

  GN_2/LN_2 top-off is not performed in this time frame because during 3.1, the only activity performed by the experimenter is monitoring.

o Media (continued)

All other activities include tow to VAB, mate to orbiter, and move to PAD. With the orbiter constantly in flow from OPF to PAD, it is physically impossible to top-off fluids. Therefore, GN_2/LN_2 top-off will be performed during final servicing, if required.

Block 3.2 Launch Readiness Verification/Access to Cabin

A. Experiment/Payload Area Requirements

o Relative Humidity

Same as 3.1 and A.1.

o Cleanliness Class

Same as 3.1 and A.2.

B. Fluids

o Cleanliness Specification

Same as 3.1 and B.1.

C. AC Power

(115VAC, 60Hz, 1PH, 1.0KW)

(110VAC, 400Hz, 3PH, 1.0KW)

During this functional block verification checks are recommended, which imposes additional power requirements above specified parameters on data sheets.

D. Other

Monitor via LPS.

Block 3.3 Payload Final Servicing

A. Experiment/Payload Area Requirements

o Relative Humidity

Same as 3.1 and A.1

- o Cleanliness Class

  Same as 3.1.A.2.

B. Fluids

- o Cleanliness Specification

  Same as 3.1.B.1.

C. AC Power

(115VAC, 60Hz, 1PH, 1.0KW)

(110VAC, 400Hz, 3PH, 1.0KW)

For top-off of LN_2, additional power is required for support/operation of GSE. At this time, the additional power parameters are not known. The power requirements are presently (TBD).

LAUNCH SITE FACILITY REQUIREMENTS (DEDICATED SOLAR SORTIE MISSION)

Block 4.0 Post Landing Operations

No data changes until function:

Block 4.4 Remove Payload

o Area Requirements: (45'long x 15'wide x 60'high)

Using the same logic applied to function 2.0, GAC describes the area as 75'long x 34'wide x 60'high. Again, note 1 is not an area cleanliness spec. Refer to function 2.0.

There are no other recommended changes.

LAUNCH SITE FACILITIES REQUIREMENTS (FUNCTIONAL)

DEDICATED SOLAR SORTIE MISSION

Block 5.0 Post Mission Processing

o Area Requirements (45'long x 15'wide x 60'high)

Given the DSSM dimensions of 44.94'long x 14'wide x 10'high, the area listed would provide space for the bare payload only. An area of 75'long x 34'wide is recommended until the pallets are removed from payload transporter, and transferred to a storage area. The height of 60' should be lowered to 20'. Reason - 20' is sufficient clearance to remove pallets from payload transporter.

For all other experiment/payload area requirements refer to Activity 1.8 (Functional).

o Fluids

(GN_2 and parameters)

For comments refer to activity 1.8 (Functional)

o A.C. Power

(115VAC, 60Hz, 1PH, 10KW)

(110VAC, 400Hz, 3PH, 3KW)

No power is required for Activity 5.0 because during this period the experimenters are removing experiments/pallets from payload transporter. If power is required for post mission processing, it would be supplied by the labs/shops supporting the experimenters and would not be defined on the Functional data sheets.

DEDICATED SOLAR SORTIE MISSION (DSSM)

SO-01-S

Differences Between

Launch Site Facility Requirements Data Sheet (Physical)

(Revision A - dated 8/21/74)

and

GAC Data

The difference in launch site requirements are included in the following pages. The Data Sheet information is shown in parenthesis and followed by GAC data and logic basis. Requirements solely generated by GAC and not reflected in the Data Sheets have not been duplicated.

1.0 Premission Processing

A. Storage Area

AREA (FT^2)

(3700)

- 75 ft. long, 35 ft. wide, and 20 ft. high for five pallet segments which allows six foot aisle between shipping containers.
- 30 ft. long, 24 ft. wide, and 5 ft. high for five (estimated) racks of DSSM GSE in their shipping containers.
- TBD area for pressurized equipment provided by Spacelab (assumed to be located in PSS/MSS and/or Orbiter cabin) - see Level B Data Sheets #S-5, S-7a, and S-7b.

TEMP(°K)

(290 ± 4; 62°F ± 7)

- Study lists no temperature requirements during storage. Data Sheet #S-24a (Ground Environmental Limits) list non-operating temperature limits as minimum = 255 (0°F) and maximum = 325 (120°F). The Study lists storage building as a protected hangar type, and assumes that a hangar at the launch site would prevent the instruments in their shipping containers from exceeding the listed min/max temperature limits.

RELATIVE HUMIDITY(%) and CLEANLINESS CLASS

(40 ± 5) (10,000)

- Study indetifies no requirements for these parameters, since instruments are stored in their shipping containers in a hangar-type environment. It is noted that Data Sheet #S-23 (Ground Facility Requirements) lists relative humidity as 30 to 60% for Supply Shipping and Receiving Facility; and Data Sheet #S-11a (In-Flight Contamination Control Criteria) lists Launch and Ascent incoming air is greater than 5,000 class; however, these requirements appear invalid for storage conditions.

Block 1.0 (continued)

B. Maintenance and Repair

Calibration Lab

(yes)

o Study lists requirements as TBD, since there is no specific calibration task described in the Level B data.

C. Special Area Requirements

Radioactive Lab

(X-ray)

o Study does not list X-ray Lab as a requirement, although Level B data, Data Sheet #S-23 (Ground Facility Requirements) calls out an X-ray Lab for the Payload Operations and Checkout Facility. The study assumes that the use of an X-ray Lab for instrument checkout would be a Level III integration task which is not performed at the launch site in accordance with Study groundrules. For contingency purposes, the listing of the X-ray Lab as a requirement is satisfactory.

Cleaning Facility

(yes)

o Study does not identify a requirement for a Cleaning Facility. Data Sheet #S-23 (Ground Facility Requirements) does not list a cleaning facility requirement, nor does Data Sheet #S-22 (Launch/Land Support Requirements).

Data Sheet #S-24a and 24b (Ground Environmental Limits) lists particulate level as 25 (column #9) and NVR as A (column #10), reference MIL-STD-1246A. A cleanliness level of 25 (Table 1a) is defined as:

In one square foot of surface area:

There are - 21 particulates of 5 micron size

Less than 4 particulates of 15 micron size

1 particulate of 25 micron size

2

Block 1.0C (continued)

Cleaning Facility (continued)

A level A NVR (non volative residue) has less than 1.0 mg of residue per square foot of surface area. These requirements are extremely high, there being only one cleanliness level in Table 1a greater than 25 (10) and no level greater than A in Table 1b. The Study concludes these requirements need investigation prior to listing facilities to support them.

Other

(Vacuum Chamber - 3 Cu.m.)

(Solar Simulator)

- Study lists no requirements for the above items. Data Sheet #S-23 (Ground Facility Requirements) lists these items as requirements under Special Handling (column 8) along with several other items, like altitude chamber, integrated test stands, and dark room. Also in column 9, Notes, other items are listed as requirements, like gamma ray source, fast neutron source, and alpha particle source.

  Basically, the Study feels that it is not necessary to stimulate a sensor to verify an interface in conducting Level II integration tasks at the launch site. Therefore, requirements for sensor stimuli were not listed.

  The need for a vacuum chamber to verify Level II integration interfaces is not identified in ground processing, and the Study does not list a vacuum chamber as a facility requirement.

D. Office

Number Engineers/Scientists

(2)

- Study estimates 10 required. Interpretation of Data Sheet #S-15 indicates 3 engineers/scientists required to operate the approximate

Block 1.0D (continued)

17 instruments during orbital mission on a 24 hour basis. These 17 instruments are mounted on five pallet segments. The Study verifies individual pallet segment interfaces in parallel, and estimates that each pallet segment requires 2 engineers/scientists and 4 technicians, totals therefore are 10 engineers/scientists, and 20 technicians.

Number Technicians

(4)

o 20. See paragraph above for logic.

LAUNCH SITE FACILITY REQUIREMENTS (PHYSICAL)
DEDICATED SOLAR SORTIE MISSION (DSSM)

2.0 Orbiter/Payload Mate and Integrate (Storage Area 3700 ft^2, Temp 290 ± 4°, Humid. 40 ± 5% Cleanlines Class 10,000).

- o In functional block 2.0 no function for storage is defined; therefore, the requirement for storage area does not exist.
- o Since an anomoly may be discussed at any point in the flow, the requirements for Maintenance and Repair and/or other Special Area Requirements should remain valid for this function.
- o Office

  GAC estimate for this function would be 4 Engineers/Scientists and 12 Technicians based on examination of the Level 'B' description.

o Power Requirements: 2.1 (N/A) 2.2 through 2.5 (28 VDC at 3.0KW, 110 VAC, 400 Hz, 3Ø, 1.5 KW)

Level 'B' data sheet S-23 shows power requirements as follows: 28 VDC at 20-30 KW 115 VAC with no identification of frequency phasing or power level. Since data sheet S-8 shows no requirement for AC power, it is assumed that the AC called for on the requirements data sheet is supporting GSE/STE. No firm requirement may be defined without further definition.

o Special Handling: 2.1

(OH crane, 4 ton capacity)

Level B data lists payload weight at 2846 kg. ERNO description book shows 6450 kg for the Spacelab. (2846 + 6450) 2.205 = 20,498 lbs. It appears that the requirement should be OH crane 11 ton capacity.

There are no other changes recommended.

LAUNCH SITE FACILITY REQUIREMENTS DATA SHEET (PHYSICAL)

Block 3.0 Prelaunch and Launch Operations

A. Storage Area

(Area - 3700ft^2)

(Temp - 290 ± 4°K)

(Rel Humid - 40 ± 5%)

(Clean Class - 10K)

No storage area facility is required in support of this activity. Storage requirements are stated in Activities 1.0 and 5.0

Blocks 3.4 & 3.5 Off-line Support

On a contingency basis, the Dedicated Solar Sortie Mission should have the capabilities to perform any maintenance, repair, servicing, and checkout to support the launch mission. Although the requirement is on a contingency basis, the following requirements should be considered as part of the physical requirements. A specific requirement is servicing LN_2 dewars, which are required for LN_2 top-off final servicing.

Power - TBD

Fluids - LN_2, GN_2

Data Processing - TBD

LAUNCH SITE FACILITY REQUIREMENTS (PHYSICAL)

Block 4.0 Post Landing Operations (Dedicated Solar Sortie Mission)

- o Storage Area (3700 ft^2)

Since no storage function is defined in this block, no storage area is required.

There are no other recommended changes.

LAUNCH SITE FACILITY REQUIREMENTS (PHYSICAL)

DEDICATED SOLAR SORTIE MISSION

Block 5.0 POST MISSION PROCESSING

For comments refer to Activity 1.0.